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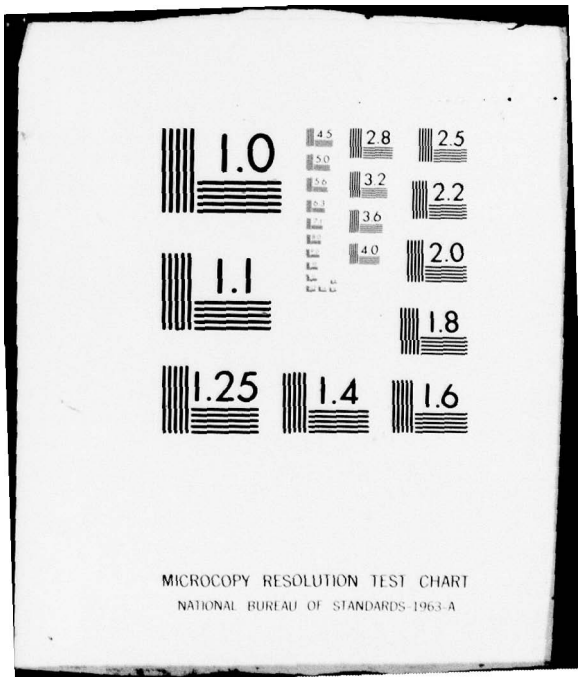
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MEMORANDUM REPORT ARBRL-MR-02990

THE CONVERGENCE OF TWO SERIES REPRESENTATIONS FOR ASSOCIATED LEGENDRE FUNCTIONS OF THE FIRST AND SECOND KIND

James N. Walbert
Kathleen L. Zimmerman

February 1980

US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
BALLISTIC RESEARCH LABORATORY
ABERDEEN PROVING GROUND, MARYLAND

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The regions of convergence and divergence of two series representations for associated Legendre functions of the first and second kind, degree ν and order μ, are investigated. The series are shown to be absolutely convergent when the real part of the complex order μ is less than zero, conditionally convergent when the real part of μ is greater than or equal to zero and less than one-half, and divergent when the real part of μ is greater than or equal to one-half. Numerical calculations for several real values of ν and μ are used to demonstrate the behavior of the partial sums of the series in the regions of convergence and divergence.

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LIST OF SYMBOLS

θ - Apex angle of a cone, in radians

$\Gamma(x)$ - The Gamma function

$(x)_k = \Gamma(x+k)/\Gamma(x)$, the Pochhammer notation

$k! = \Gamma(k+1)$, factorial notation

a,b,c - arbitrary complex numbers

P_ν^μ - Associated Legendre function of the first kind, of degree ν and order μ.

Q_ν^μ - Associated Legendre function of the second kind, of degree ν and order μ.

Re {a} - the real part of the complex number a.

Im {a} - the imaginary part of the complex number a.

sinh x, cosh x - the hyperbolic sine and cosine, respectively, of x.

$i^2 = -1$

$O(k)$ - Landau symbol

Other terms are defined as they occur in the text.

I. INTRODUCTION

For stresses in a pressurized cone, the method of Papkovich-Neuber[1] leads to displacements and strains expressed in terms of Legendre functions. In spherical coordinates, the argument at which these Legendre functions are evaluated is the cosine of the apex angle θ of the cone. Computation of Legendre functions using Gaussian quadratures on certain integral representations[2] is required in the stress analysis for the minihat gage, a strain-type pressure transducer.[3]

For the purpose of verification of the quadrature results, use was made of the series representations

$$P_\nu^\mu(\cos\theta) = \pi^{-\frac{1}{2}}\, 2^{\mu+1} (\sin\theta)^\mu \frac{\Gamma(\nu+\mu+1)}{\Gamma\left(\nu+\frac{3}{2}\right)} \times \sum_{k=0}^{\infty} \frac{(\mu+\frac{1}{2})_k (\nu+\mu+1)_k}{k!\left(\nu+\frac{3}{2}\right)_k} \sin[(2k+\mu+\nu+1)\theta] \tag{1}$$

$$Q_\nu^\mu(\cos\theta) = \pi^{\frac{1}{2}}\, 2^{\mu} (\sin\theta)^\mu \frac{\Gamma(\nu+\mu+1)}{\Gamma\left(\nu+\frac{3}{2}\right)} \times \sum_{k=0}^{\infty} \frac{(\mu+\frac{1}{2})_k (\mu+\nu+1)_k}{k!\left(\nu+\frac{3}{2}\right)_k} \cos[(2k+\mu+\nu+1)\theta], \tag{2}$$

where $0 < \theta < \pi$. In at least two references[4,5] there

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[1] *A. I. Lure', Three Dimensional Problems of the Theory of Elasticity, 1964, paragraph 1.10.*

[2] *W. Magnus, and F. Oberhettinger, Formulas and Theorems for the Special Functions of Mathematical Physics, 1949, p67.*

[3] *H. Gay, "The Evolution of Gages for Measuring Pressures in Guns and Pockets at the Ballistic Research Laboratories", BRL Memorandum Report No. 1402, 1962.* (AD #283309)

[4] *Handbook of Mathematical Functions, National Bureau of Standards, U.S. Department of Commerce, 1964, 8.7.1, 8.7.2.*

[5] *A. Erdelyi, et al, Higher Transcendental Functions, Vol. I, Bateman Manuscript Project, 1953, 3.5(2),3.5(3).*

are no stated restrictions on μ or ν for the convergence of these series. However, calculation of the first 50 partial sums of the series in equation (1) with $\theta=\frac{\pi}{6}$, $\mu=1$, and $\nu=.05$ indicated that these partial sums were increasing without bound (see Appendix A).

Indeed, since

$$\frac{(\mu+\frac{1}{2})_k(\mu+\nu+1)_k}{k!(\nu+\frac{3}{2})_k} = \frac{\Gamma(\nu+\frac{3}{2})}{\Gamma(\mu+\frac{1}{2})\ \Gamma(\mu+\nu+1)}\ \frac{\Gamma(\mu+\frac{1}{2}+k)\Gamma(\mu+\nu+1+k)}{\Gamma(1+k)\Gamma(\nu+\frac{3}{2}+k)}\ , \qquad (3)$$

one sees at a glance that for real μ and ν with $\mu \geq \frac{1}{2}$, the term in brackets is greater than or equal to 1 for every positive integral k, giving scant hope for the convergence of the series in Eqs. (1) and (2) in this case.

It is the purpose of this report to identify the region of convergence of these series, and to indicate by numerical computation the behavior of the partial sums for various values of the parameters μ and ν.

In reference 4, for example, the convergence criteria for series representations of the Legendre functions are not complete, and should be supplemented by the more general convergence criteria for the hypergeometric function.

II. ANALYSIS OF CONVERGENCE

To simplify our notation, we write

$$a=\mu+\frac{3}{2}$$

$$b=\mu+\nu+1$$

$$c=\nu+\frac{3}{2}\ . \qquad (4)$$

The series in Eqs. (1) and (2) are then

$$S = \sum_{k=o}^{\infty} \frac{(a)_k(b)_k}{k!(c)_k} \sin\,[(2k+b)\theta]\ , \qquad (5)$$

and

$$C = \sum_{k=o}^{\infty} \frac{(a)_k (b)_k}{k!(c)_k} \cos[(2k+b)\theta] \ , \tag{6}$$

respectively.

Since

$$\sin [(2k+b)\theta] = \frac{1}{2i} \left(e^{i(2k+b)\theta} - e^{-i(2k+b)\theta} \right) \ ,$$

and

$$\cos [(2k+b)\theta] = \frac{1}{2} \left(e^{i(2k+b)\theta} + e^{-i(2k+b)\theta} \right) \ ,$$

we can write

$$2iS = \sum_{k=o}^{\infty} \frac{(a)_k (b)_k}{k!(c)_k} \left[e^{ib\theta} (e^{i2\theta})^k - e^{-ib\theta} (e^{-i2\theta})^k \right]$$

$$= e^{ib\theta} \sum_{k=o}^{\infty} \frac{(a)_k (b)_k}{k!(c)_k} (e^{i2\theta})^k - e^{-ib\theta} \sum_{k=o}^{\infty} \frac{(a)_k (b)_k}{k!(c)_k} (e^{-i2\theta})^k$$

$$= e^{ib\theta} F(a,b;c;e^{i2\theta}) - e^{-ib\theta} F(a,b;c;e^{-i2\theta});$$

similarly,

$$2C = e^{ib\theta} F(a,b;c;e^{i2\theta}) + e^{-ib\theta} F(a,b;c;e^{-i2\theta}),$$

where

$$F(a,b;c;z) = \sum_{k=o}^{\infty} \frac{(a)_k (b)_k}{k!(c)_k} z^k \tag{7}$$

is the hypergeometric function. These representations for S and C as

linear combinations of hypergeometric functions are valid only on the intersections of the regions of convergence of the various forms in which the series in Eq. (7) appears.

It is known (see Appendix B) that on $|z|=1$, the series in Eq. (7) exhibits the following behavior:

I) Absolute convergence if $\mathrm{Re}\{a+b-c\}< 0$;

II) Conditional convergence if $z \neq 1$ and $0 \leq \mathrm{Re}\{a+b-c\} < 1$;

III) Divergence if $\mathrm{Re}\{a+b-c\} \geq 1$.

Since a finite linear combination of convergent series is convergent, we have immediately that the series in Eqs. (5) and (6) are convergent for $\mathrm{Re}\{a+b-c\}< 1$ and $0< \theta< \pi$. Moreover, use of the triangle inequality shows that these series converge absolutely for $\mathrm{Re}\{a+b-c\}< 0$.

By Eq. (4), one sees that

$$\begin{aligned}\mathrm{Re}\{a+b-c\} &= \mathrm{Re}\{(\mu+\tfrac{1}{2})+(\mu+\nu+1)-(\nu+\tfrac{3}{2})\} \\ &= \mathrm{Re}\{2\mu\} \\ &= 2\mathrm{Re}\{\mu\}.\end{aligned}$$

Therefore, the series in Eqs. (5) and (6) converge absolutely for $\mathrm{Re}\{\mu\}< 0$ and at least conditionally for $\mathrm{Re}\{\mu\}<\frac{1}{2}$ if $0 < \theta < \pi$. It should be noted that we have assumed that a,b, and c are not negative integers, so that the expressions involving the gamma function are meaningful; this assumption of course imposes additional discrete restrictions on the values of μ and ν .

Continuing the analysis, we will develop an asymptotic expansion for large k of

$$w(a,b,c,k) = \frac{\Gamma(a+k)\Gamma(b+k)}{\Gamma(1+k)\Gamma(c+k)} . \tag{8}$$

To this end (see Appendix C), we observe that

$$\log \Gamma(k+x) = \log \Gamma((k) + x \log k + \mathcal{O}(\frac{1}{k}) , \tag{9}$$

for large k. Using Eq. (9) in Eq. (8), we have

$$\log w(a,b,c,k) = \log \Gamma(k+a) + \log \Gamma(k+b) - \log \Gamma(k+c) - \log \Gamma(k+1)$$

$$= [\log \Gamma(k) + a \log k + O(\tfrac{1}{k})]$$

$$+ [\log \Gamma(k) + b \log k + O(\tfrac{1}{k})]$$

$$- [\log \Gamma(k) + c \log k + O(\tfrac{1}{k})]$$

$$- [\log \Gamma(k) + \log k + O(\tfrac{1}{k})]$$

$$= (a+b-c-1) \log k + O(\tfrac{1}{k}) \ .$$

Thus

$$w(a,b,c,k) = k^{a+b-c-1}[1 + O(\tfrac{1}{k})] \ , \tag{10}$$

and so

$$w(a,b,c,k) \sim k^{a+b-c-1} \text{ as } k \to \infty^{6}. \tag{11}$$

For real values of x and y,

$$|\sin(x+iy)| = (\sin^2 x + \sinh^2 y)^{\frac{1}{2}}, \tag{12}$$

and

$$|\cos(x+iy)| = (\cos^2 x + \sinh^2 y)^{\frac{1}{2}}. \tag{13}$$

Since $\sin^2 x \leq$ and $\cos^2 x \leq 1$ and $1 + \sinh^2 y = \cosh^2 y$,

$$(\sin^2 x + \sinh^2 y)^{\frac{1}{2}} \leq \cosh y,$$

and $(\cos^2 x + \sinh^2 y)^{\frac{1}{2}} \leq \cosh y$.

Also, $\sin^2 x \geq 0$ and $\cos^2 x \geq 0$, so that

$$(\sin^2 x + \sinh^2 y)^{\frac{1}{2}} \geq |\sinh y|$$

and $(\cos^2 x + \sinh^2 y)^{\frac{1}{2}} \geq |\sinh y|$

This shows that

$$|\sinh(\theta \cdot \mathrm{Im}\{b\})| \leq |\sin[(2k+b)\theta]| \leq \cosh(\theta \cdot \mathrm{Im}\{b\}) \ , \tag{14}$$

[6] *F. W. J. Olver, Asymptotics and Special Functions, 1974, pg. 301.*

and

$$|\sinh(\theta \cdot \mathrm{Im}\{b\})| \leq |\cos[(2k+b)\theta]| \leq \cosh(\theta \cdot \mathrm{Im}\{b\}). \tag{15}$$

For fixed θ and b, the upper bound, $\cosh(\theta \cdot \mathrm{Im}\{b\})$, is finite and independent of k. If $0 < \theta < \pi$ and $\mathrm{Im}\{b\} \neq 0$,

$|\sinh(\theta \cdot \mathrm{Im}\{b\})| = \rho > 0$. If $0 < \theta < \pi$ and $\mathrm{Im}\{b\} = 0$,

$|\sin[(2k+b)\theta]|$ and $|\cos[(2k+b)\theta]|$ can be neither constantly zero nor remain arbitrarily close to zero as k varies. Therefore, the expressions

$$|k|^{\mathrm{Re}\{a+b-c-1\}} |\sin[(2k+b)\theta]|, \tag{16}$$

and

$$|k|^{\mathrm{Re}\{a+b-c-1\}} |\cos[(2k+b)\theta]| \tag{17}$$

will tend to zero as $k \to \infty$ only if $\mathrm{Re}\{a+b-c-1\} < 0$.

Using Eqs. (8), (11), (16), and (17), we see that the kth term of the series in Eqs. (5) and (6) cannot tend to zero in absolute value as $k \to \infty$ when $\mathrm{Re}\{a+b-c-1\} \geq 0$. Since

$$a+b-c-1 = 2\mu-1,$$

we conclude that the series in Eqs. (5) and (6) diverge for $\mathrm{Re}\{\mu\} \geq \frac{1}{2}$.

III. NUMERICAL ASPECTS OF CONVERGENCE

To illustrate numerically the convergence and divergence properties obtained, use was made of the following formulae[2,4]

$$P_\nu^1(\cos\theta) = -\frac{\Gamma(\nu+2)}{\Gamma(\nu)} \sqrt{\frac{2}{\pi}} \frac{(\sin\theta)^{-1}}{\Gamma\left(\frac{3}{2}\right)} \int_0^\theta \cos[(\nu+\tfrac{1}{2})\phi](\cos\phi-\cos\theta)^{\frac{1}{2}} d\phi; \tag{18}$$

$$P_\nu^{\frac{1}{2}}(\cos\theta) = \left(\frac{\pi}{2}\right)^{-\frac{1}{2}} (\sin\theta)^{-\frac{1}{2}} \cos(\nu+\tfrac{1}{2})\theta; \tag{19}$$

$$Q_\nu^{\frac{1}{2}}(\cos\theta) = -\frac{\pi}{2}^{-\frac{1}{2}}(\sin\theta)^{-\frac{1}{2}}\sin(\nu+\tfrac{1}{2})\theta; \tag{20}$$

$$P_\nu^{-\frac{1}{2}}(\cos\theta) = \frac{\pi}{2}^{-\frac{1}{2}}(\nu+\tfrac{1}{2})^{-1}(\sin\theta)^{-\frac{1}{2}}\sin(\nu+\tfrac{1}{2})\theta; \tag{21}$$

$$Q_\nu^{-\frac{1}{2}}(\cos\theta) = (2\pi)^{\frac{1}{2}}(2\nu+1)^{-1}(\sin\theta)^{-\frac{1}{2}}\cos(\nu+\tfrac{1}{2})\theta. \tag{22}$$

These associated Legendre functions were computed for

ν=-.4,.05,-1.5, and 1.5, with $\theta=\frac{\pi}{6}$. From the recurrence formula[5]

$$T_\nu^{\mu+2}(\cos\theta)+2(\mu+1)(\cos\theta)(1-\cos^2\theta)^{-\frac{1}{2}}T_\nu^{\mu+1}(\cos\theta) + (\nu-\mu)(\nu+\mu+1)T_\nu^{\mu}(\cos\theta) = 0, \tag{23}$$

where T stands for either P or Q, one obtains values for $P_\nu^{\frac{3}{2}}(\cos\theta)$ from Eqs. (19) and (21), and values for $Q_\nu^{\frac{3}{2}}(\cos\theta)$ from Eqs. (20) and (22).

With ν and θ as above, the sums of the first fifty terms of the series in Eqs. (1) and (2) were computed for $\mu=\pm\frac{1}{2},\pm1,0$, and $\frac{3}{2}$. The values of $P_\nu^{-\frac{1}{2}}$ and $Q_\nu^{-\frac{1}{2}}$ thus computed agree quite well with those obtained from Eqs. (21) and (22), while the values for $P_\nu^{\frac{1}{2}}$, $Q_\nu^{\frac{1}{2}}$, and P_ν^{1} do not agree with the values obtained from Eqs. (13) - (20), as expected, since these values of μ are outside the region of convergence of the series. Indeed, one sees that the terms of the sequence of partial sums increase quite rapidly for $\mu=\frac{1}{2}$ and 1. This growth behavior is again exhibited in the partial sums when $\mu=\frac{3}{2}$. Using the series approximations for the values μ=-1 and 0 in the recurrence relation (23), the value of P_ν^{1} obtained agrees well with that computed from Eq. (18). The results are tabulated in Appendix A.

IV. CONCLUSIONS

At $\theta=0$ or π, the term $(\sin\theta)^\mu$ is meaningless, so the series representations in Eqs. (1) and (2) are not valid there. Indeed, ±1 are singular points of the associated Legendre functions. The series in Eqs. (5) and (6) do converge absolutely for $0\leq\theta<\pi$ when $\mathrm{Re}\{\mu\}<0$, however.

V. SUMMARY

It is shown that the series representations

$$P_\nu^\mu(\cos\theta) = \pi^{-\frac{1}{2}} 2^{\mu+1} (\sin\theta)^\mu \frac{\Gamma(\nu+\mu+1)}{\Gamma\left(\nu+\frac{3}{2}\right)} \sum_{k=0}^{\infty} \frac{(\mu+\frac{1}{2})_k (\mu+\nu+1)_k}{k!\ (\nu+\frac{3}{2})_k} \sin[(2k+\mu+\nu+1)\theta]$$

and

$$Q_\nu^\mu(\cos\theta) = \pi^{\frac{1}{2}} 2^{\mu} (\sin\theta)^\mu \frac{\Gamma(\nu+\mu+1)}{\Gamma\left(\nu+\frac{3}{2}\right)} \sum_{k=0}^{\infty} \frac{(\mu+\frac{1}{2})_k (\mu+\nu+1)_k}{k!\ (\nu+\frac{3}{2})_k} \cos[(2k+\mu+\nu+1)\theta],$$

for the associated Legendre functions of the first and second kind, respectively, of complex order μ and degree ν with $0<\theta<\pi$, converge absolutely for $\mathrm{Re}\{\mu\}<0$, converge at least conditionally for $0\leq\mathrm{Re}\{\mu\}<\frac{1}{2}$, and diverge for $\mathrm{Re}\{\mu\}\geq\frac{1}{2}$.

Numerical computations for real μ and ν are presented to illustrate the behavior of the partial sums in the regions of convergence and divergence. A method is indicated whereby these series representations may be used to compute the values of $P_\nu^\mu(\cos\theta)$ for arbitrary complex μ and ν.

VI. ACKNOWLEDGMENTS

Mr. A. S. Elder verified a large portion of the analysis, and provided the authors with a great deal of insight to the problem.

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APPENDIX A

NUMERICAL ASPECTS OF CONVERGENCE AND DIVERGENCE

Tables of the first 50 partial sums (PSP) of $P_\nu^\mu(\cos\theta)$ and the partial sums (QSP) of $Q_\nu^\mu(\cos\theta)$ for ν=-1.5, -.4, .05, 1.5; μ=± 1.0, ± .5, 0, 1.5; and $\theta = \pi/6$ are given in this appendix. The functional values PUV (COS THETA) = $P_\nu^\mu(\cos\theta)$ and QUV (COS THETA) = $Q_\nu^\mu(\cos\theta)$, are listed at the bottom of each table. A discussion of these equations begins on page 12 of the text.

MU =-1.00 NU =-1.50 THETA = 30.0 DEGREES

K	PSP	QSP
1	-.167108551642066592E-99	.167108551642066592E-99
2	.458744813179650780E+00	.171205895049514944E+01
3	.244737444367757088E+00	.165471584884769308E+01
4	.225154410972202421E+00	.167429888224324775E+01
5	.227394375880306184E+00	.168265854508746235E+01
6	.231051728374650071E+00	.168363852973475775E+01
7	.232457346494350528E+00	.168223291161505729E+01
8	.232154163744093515E+00	.168110141818711965E+01
9	.231431826421794039E+00	.168090786848494665E+01
10	.231073793137333407E+00	.168126590176940728E+01
11	.231166619708905096E+00	.168161233525080525E+01
12	.231420933378204059E+00	.168168047839311810E+01
13	.231561619060528790E+00	.168153979271079337E+01
14	.231521760310901793E+00	.168139103783205925E+01
15	.231404268476736794E+00	.168135955598997748E+01
16	.231335153304527050E+00	.168142867116218723E+01
17	.231355786911404857E+00	.168150567683139861E+01
18	.231419415676681539E+00	.168152272610766988E+01
19	.231458346082933606E+00	.168148379570141782E+01
20	.231446315240165748E+00	.168143889598495030E+01
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49	.231415314588848292E+00	.168146516472838424E+01
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PUV (COS THETA) = .261123486338710080E+00
QUV (COS THETA) = .298031510586655852E+01

MU =-1.00 NU = -.40 THETA = 30.0 DEGREES

K	PSP	QSP
1	.8136338567495462 32E+00	-.3827846340554994 64E+01
2	.2848710850533364 90E+00	-.4303946478664397 31E+01
3	.2365356421821845 39E+00	-.4288241341249419 62E+01
4	.2338087587075316 80E+00	-.4275412363149528 55E+01
5	.2376718114399418 89E+00	-.4271934054845930 58E+01
6	.2401146449483094 52E+00	-.4272727779567416 93E+01
7	.2404166788642256 50E+00	-.4274148737422319 96E+01
8	.2397476504099696 15E+00	-.4274751133348282 42E+01
9	.2391808113844736 43E+00	-.4274566956184305 31E+01
10	.2390945684984300 55E+00	-.4274161215305896 33E+01
11	.2393176758251033 20E+00	-.4273960328566647 25E+01
12	.2395309439125091 37E+00	-.4274029623568823 32E+01
13	.2395666816460893 49E+00	-.4274197756386269 30E+01
14	.2394666211304971 54E+00	-.4274287851279183 04E+01
15	.2393644498063078 19E+00	-.4274254653804213 57E+01
16	.2393463444939887 21E+00	-.4274169474997326 37E+01
17	.2393995278349411 58E+00	-.4274121588502043 52E+01
18	.2394561413014662 67E+00	-.4274139983332389 55E+01
19	.2394665460906500 86E+00	-.4274188934016866 53E+01
20	.2394349821235987 83E+00	-.4274217354340453 60E+01
21	.2394004054613010 19E+00	-.4274206119701843 07E+01
22	.2393938855064897 06E+00	-.4274175445726125 32E+01
23	.2394141271261636 10E+00	-.4274157220089907 80E+01
24	.2394367699466292 56E+00	-.4274164577188255 36E+01
25	.2394411217150944 34E+00	-.4274185050649206 11E+01
26	.2394273741285066 52E+00	-.4274197429031769 08E+01
27	.2394117481699806 40E+00	-.4274192351850071 46E+01
28	.2394087005111898 55E+00	-.4274178013742760 92E+01
29	.2394184599321223 91E+00	-.4274169226320683 26E+01
30	.2394296932411465 03E+00	-.4274172876244039 06E+01
31	.2394319099233466 22E+00	-.4274183304913859 95E+01
32	.2394247338044452 44E+00	-.4274189766320340 93E+01
33	.2394163895267582 39E+00	-.4274187055100169 59E+01
34	.2394147271975495 19E+00	-.4274179234456122 38E+01
35	.2394201569402331 86E+00	-.4274174345493850 51E+01
36	.2394265237377732 47E+00	-.4274176414191773 20E+01
37	.2394278021741386 09E+00	-.4274182428761990 73E+01
38	.2394235951366602 36E+00	-.4274186216795550 77E+01
39	.2394186272162911 88E+00	-.4274184602620373 55E+01
40	.2394176230053267 97E+00	-.4274179878179234 21E+01
41	.2394209485529919 52E+00	-.4274176883842667 00E+01
42	.2394248991492434 93E+00	-.4274178167469200 99E+01
43	.2394257022774937 77E+00	-.4274181945890549 05E+01
44	.2394230281928373 42E+00	-.4274184353647188 50E+01
45	.2394198350725233 79E+00	-.4274183316139506 05E+01
46	.2394191827316991 94E+00	-.4274180247117222 95E+01
47	.2394213649852985 08E+00	-.4274178282207256 44E+01
48	.2394239825387573 61E+00	-.4274179132701931 17E+01
49	.2394245195961520 21E+00	-.4274181659358320 60E+01
50	.2394227155890673 96E+00	-.4274183283693595 54E+01

PUV (COS THETA) = .2701596044001376 63E+00

QUV (COS THETA) = -.7575792620658697 10E+01

MU =-1.00 NU = .05 THETA = 30.0 DEGREES

K	PSP	QSP
1	.573389094124100302E+00	.218968460823165902E+02
2	.262906521267552242E+00	.217282677997457212E+02
3	.231897101684802442E+00	.217472703965057921E+02
4	.232171981201488736E+00	.217577676217403527E+02
5	.236038234720196846E+00	.217598668261245825E+02
6	.237954332598154616E+00	.217586926398348167E+02
7	.237920316675119689E+00	.217573936241425466E+02
8	.237201306854259488E+00	.217570032336622145E+02
9	.236733950151301496E+00	.217572896302181297E+02
10	.236744029047381258E+00	.217576745277308306E+02
11	.236990750834588045E+00	.217578084867314195E+02
12	.237170633693602696E+00	.217576982543736424E+02
13	.237166378987016857E+00	.217575357736843683E+02
14	.237054008737564049E+00	.217574747616169581E+02
15	.236966701927194290E+00	.217575282632991627E+02
16	.236968881592398611E+00	.217576115013550991E+02
17	.237029186936843972E+00	.217576442444855843E+02
18	.237077973899013188E+00	.217576143477967161E+02
19	.237076711929352986E+00	.217575661551197134E+02
20	.237040683668720124E+00	.217575465933702547E+02
21	.237010710306373188E+00	.217575649610703241E+02
22	.237011505313664511E+00	.217575953211739097E+02
23	.237034721310486339E+00	.217576079264317069E+02
24	.237054435681406054E+00	.217575958454496696E+02
25	.237053902927230996E+00	.217575755003885401E+02
26	.237038077392936756E+00	.217575669078244952E+02
27	.237024426482914202E+00	.217575752731129158E+02
28	.237024800746327102E+00	.217575895656560257E+02
29	.237036067683244332E+00	.217575956831036424E+02
30	.237045907414126316E+00	.217575896533088028E+02
31	.237045634519504451E+00	.217575792318836434E+02
32	.237037330661744143E+00	.217575747232567434E+02
33	.237030005661296723E+00	.217575792120227907E+02
34	.237030210726988579E+00	.217575870431656174E+02
35	.237036505793938648E+00	.217575904611080975E+02
36	.237042104941443016E+00	.217575870299460939E+02
37	.237041946964984809E+00	.217575809970685498E+02
38	.237037061635952892E+00	.217575783445513073E+02
39	.237032686070360965E+00	.217575810259013506E+02
40	.237032810339205796E+00	.217575857715370733E+02
41	.237036677325820593E+00	.217575878711394962E+02
42	.237040161378247798E+00	.217575857361094229E+02
43	.237040061870421318E+00	.217575819360588416E+02
44	.237036948762247186E+00	.217575802457790149E+02
45	.237034129579724903E+00	.217575819733762865E+02
46	.237034210491307840E+00	.217575850632649781E+02
47	.237036753614958012E+00	.217575864440684588E+02
48	.237039066890734780E+00	.217575850264912397E+02
49	.237039000215777207E+00	.217575824802773362E+02
50	.237036896003740911E+00	.217575813377834179E+02

PUV (COS THETA) = .267467495283606802E+00
QUV (COS THETA) = .385643088285442081E+02

MU =-1.00 NU = 1.50 THETA = 30.0 DEGREES

K	PSP	QSP
1	.3133285343288746 64E+00	.3133285343288746 64E+00
2	.2063248499229278 18E+00	.3420000851526028 39E+00
3	.2018449201067202 91E+00	.3587194108410320 34E+00
4	.2061287086619978 75E+00	.3630031993963096 17E+00
5	.2088717230327557 89E+00	.3622682109108380 70E+00
6	.2092759666997651 40E+00	.3607595530069212 17E+00
7	.2086029642741496 31E+00	.3600865505813057 08E+00
8	.2080010165055667 35E+00	.3602478419997832 11E+00
9	.2078896246196807 09E+00	.3606635621774607 74E+00
10	.2081086487690761 34E+00	.3608825863268561 98E+00
11	.2083311732297127 27E+00	.3608229610773324 52E+00
12	.2083767260864292 95E+00	.3606529555016363 13E+00
13	.2082794973997265 06E+00	.3605557268149335 24E+00
14	.2081737547489780 07E+00	.3605840604728071 11E+00
15	.2081508285191137 76E+00	.3606696223274864 22E+00
16	.2082022265759473 27E+00	.3607210203843199 73E+00
17	.2082605529441176 19E+00	.3607053918810713 03E+00
18	.2082736774998643 74E+00	.3606564103721976 44E+00
19	.2082432737916921 87E+00	.3606260066640254 57E+00
20	.2082077527988946 91E+00	.3606355244853598 8E+00
21	.2081995490858467 67E+00	.3606661411592654 66E+00
22	.2082190038142930 76E+00	.3606855958877117 75E+00
23	.2082422197614067 88E+00	.3606793751934311 33E+00
24	.2082476858584246 91E+00	.3606589754416412 16E+00
25	.2082344932667691 26E+00	.3606457828499856 51E+00
26	.2082184942547032 80E+00	.3606500697723483 90E+00
27	.2082146710619230 48E+00	.3606643381220513 44E+00
28	.2082240256804314 26E+00	.3606736927405597 22E+00
29	.2082355150527982 40E+00	.3606706141725124 93E+00
30	.2082382931265783 44E+00	.3606602462600179 69E+00
31	.2082314207648048 96E+00	.3606533738982445 21E+00
32	.2082228932648564 16E+00	.3606556588349691 72E+00
33	.2082208115152899 54E+00	.3606634280301198 44E+00
34	.2082260077723918 91E+00	.3606686242872217 81E+00
35	.2082325101239315 55E+00	.3606668819873778 25E+00
36	.2082341101471666 32E+00	.3606609106193712 25E+00
37	.2082300863051318 82E+00	.3606568867773364 75E+00
38	.2082250153123920 14E+00	.3606582455457459 47E+00
39	.2082237591220581 91E+00	.3606629337118957 49E+00
40	.2082269383679477 60E+00	.3606661129577853 17E+00
41	.2082309691504573 17E+00	.3606650329128670 16E+00
42	.2082319733839413 36E+00	.3606612850624819 95E+00
43	.2082294179453099 24E+00	.3606587296238505 83E+00
44	.2082261612238484 56E+00	.3606596022597361 57E+00
45	.2082253458223570 57E+00	.3606626453795306 24E+00
46	.2082274305559037 94E+00	.3606647301130773 61E+00
47	.2082300994001291 73E+00	.3606640149984224 46E+00
48	.2082307704993683 98E+00	.3606615104219647 39E+00
49	.2082290476037446 55E+00	.3606597875263409 95E+00
50	.2082268332331981 45E+00	.3606603808651406 76E+00

PUV (COS THETA) = .2349588206506123 21E+00
QUV (COS THETA) = .6392538809334686 77E+00

MU = -.50 NU =-1.50 THETA = 30.0 DEGREES

K	PSP	QSP
1	-.4999999999999360E+00	.8660254037844375 3E+00
2	0.	.1732050807568875 08E+01
3	.4999999999999701-100	.1732050807568875 08E+01
4	.5833333333333298 4-100	.1732050807568875 08E+01
5	.5416666666666634 2-100	.1732050807568875 08E+01
6	.4916666666666637 2-100	.1732050807568875 08E+01
7	.4749999999999971 6-100	.1732050807568875 08E+01
8	.4869047619047616 13-100	.1732050807568875 08E+01
9	.5047619047619044 60-100	.1732050807568875 08E+01
10	.5117063492063489 00-100	.1732050807568875 08E+01
11	.5061507936507933 48-100	.1732050807568875 08E+01
12	.4970598845598842 62-100	.1732050807568875 08E+01
13	.4932720057720054 76-100	.1732050807568875 08E+01
14	.4964771339771336 79-100	.1732050807568875 08E+01
15	.5019716394716391 71-100	.1732050807568875 08E+01
16	.5043525918525915 50-100	.1732050807568875 08E+01
17	.5022692585192582 18-100	.1732050807568875 08E+01
18	.4985927879310229 26-100	.1732050807568875 08E+01
19	.4969588010029183 52-100	.1732050807568875 08E+01
20	.4984207893070119 18-100	.1732050807568875 08E+01
21	.5010523682543803 38-100	.1732050807568875 08E+01
22	.5022428444448565 28-100	.1732050807568875 08E+01
23	.5011605933626054 46-100	.1732050807568875 08E+01
24	.4991843087776252 10-100	.1732050807568875 08E+01
25	.4982785116761759 35-100	.1732050807568875 08E+01
26	.4991118450095092 68-100	.1732050807568875 08E+01
27	.5006503065479708 06-100	.1732050807568875 08E+01
28	.5013625572602215 17-100	.1732050807568875 08E+01
29	.5007011815988458 56-100	.1732050807568875 08E+01
30	.4994696545052497 98-100	.1732050807568875 08E+01
31	.4988949418615716 38-100	.1732050807568875 08E+01
32	.4994325762701737 88-100	.1732050807568875 08E+01
33	.5004406407863028 19-100	.1732050807568875 08E+01
34	.5009141256347876 68-100	.1732050807568875 08E+01
35	.5004684928362136 93-100	.1732050807568875 08E+01
36	.4996281567017599 12-100	.1732050807568875 08E+01
37	.4992313313049345 15-100	.1732050807568875 08E+01
38	.4996067066803098 90-100	.1732050807568875 08E+01
39	.5003179442336527 06-100	.1732050807568875 08E+01
40	.5006553261499819 91-100	.1732050807568875 08E+01
41	.5003348133294691 71-100	.1732050807568875 08E+01
42	.4997250572319081 95-100	.1732050807568875 08E+01
43	.4994346971854505 88-100	.1732050807568875 08E+01
44	.4997115521134683 07-100	.1732050807568875 08E+01
45	.5002400933396839 51-100	.1732050807568875 08E+01
46	.5004926185922092 04-100	.1732050807568875 08E+01
47	.5002510726984893 97-100	.1732050807568875 08E+01
48	.4997885380083876 40-100	.1732050807568875 08E+01
49	.4995669068027138 81-100	.1732050807568875 08E+01
50	.4997794918367274 86-100	.1732050807568875 08E+01

PUV (COS THETA) = .5639407667301450 87-100

QUV (COS THETA) = .3069980123839461 54E+01

MU = -.50 NU = -.40 THETA = 30.0 DEGREES

K	PSP	QSP
1	.5233595624294376 57E+00	.9986295347545725 95E+01
2	.5233595624294376 57E+00	.9986295347545725 95E+01
3	.5233595624294376 57E+00	.9986295347545725 95E+01
4	.5233595624294376 57E+00	.9986295347545725 95E+01
5	.5233595624294376 57E+00	.9986295347545725 95E+01
6	.5233595624294376 57E+00	.9986295347545725 95E+01
7	.5233595624294376 57E+00	.9986295347545725 95E+01
8	.5233595624294376 57E+00	.9986295347545725 95E+01
9	.5233595624294376 57E+00	.9986295347545725 95E+01
10	.5233595624294376 57E+00	.9986295347545725 95E+01
11	.5233595624294376 57E+00	.9986295347545725 95E+01
12	.5233595624294376 57E+00	.9986295347545725 95E+01
13	.5233595624294376 57E+00	.9986295347545725 95E+01
14	.5233595624294376 57E+00	.9986295347545725 95E+01
15	.5233595624294376 57E+00	.9986295347545725 95E+01
16	.5233595624294376 57E+00	.9986295347545725 95E+01
17	.5233595624294376 57E+00	.9986295347545725 95E+01
18	.5233595624294376 57E+00	.9986295347545725 95E+01
19	.5233595624294376 57E+00	.9986295347545725 95E+01
20	.5233595624294376 57E+00	.9986295347545725 95E+01
21	.5233595624294376 57E+00	.9986295347545725 95E+01
22	.5233595624294376 57E+00	.9986295347545725 95E+01
23	.5233595624294376 57E+00	.9986295347545725 95E+01
24	.5233595624294376 57E+00	.9986295347545725 95E+01
25	.5233595624294376 57E+00	.9986295347545725 95E+01
26	.5233595624294376 57E+00	.9986295347545725 95E+01
27	.5233595624294376 57E+00	.9986295347545725 95E+01
28	.5233595624294376 57E+00	.9986295347545725 95E+01
29	.5233595624294376 57E+00	.9986295347545725 95E+01
30	.5233595624294376 57E+00	.9986295347545725 95E+01
31	.5233595624294376 57E+00	.9986295347545725 95E+01
32	.5233595624294376 57E+00	.9986295347545725 95E+01
33	.5233595624294376 57E+00	.9986295347545725 95E+01
34	.5233595624294376 57E+00	.9986295347545725 95E+01
35	.5233595624294376 57E+00	.9986295347545725 95E+01
36	.5233595624294376 57E+00	.9986295347545725 95E+01
37	.5233595624294376 57E+00	.9986295347545725 95E+01
38	.5233595624294376 57E+00	.9986295347545725 95E+01
39	.5233595624294376 57E+00	.9986295347545725 95E+01
40	.5233595624294376 57E+00	.9986295347545725 95E+01
41	.5233595624294376 57E+00	.9986295347545725 95E+01
42	.5233595624294376 57E+00	.9986295347545725 95E+01
43	.5233595624294376 57E+00	.9986295347545725 95E+01
44	.5233595624294376 57E+00	.9986295347545725 95E+01
45	.5233595624294376 57E+00	.9986295347545725 95E+01
46	.5233595624294376 57E+00	.9986295347545725 95E+01
47	.5233595624294376 57E+00	.9986295347545725 95E+01
48	.5233595624294376 57E+00	.9986295347545725 95E+01
49	.5233595624294376 57E+00	.9986295347545725 95E+01
50	.5233595624294376 57E+00	.9986295347545725 95E+01

PUV (COS THETA) = .5905480271456007 79E+00

QUV (COS THETA) = .1770024764503726 05E+02

MU = -.50 NU = .05 THETA = 30.0 DEGREES

K	PSP	QSP
1	.5163915358253131 89E+00	.1743308608851257 86E+01
2	.5163915358253131 89E+00	.1743308608851257 86E+01
3	.5163915358253131 89E+00	.1743308608851257 86E+01
4	.5163915358253131 89E+00	.1743308608851257 86E+01
5	.5163915358253131 89E+00	.1743308608851257 86E+01
6	.5163915358253131 89E+00	.1743308608851257 86E+01
7	.5163915358253131 89E+00	.1743308608851257 86E+01
8	.5163915358253131 89E+00	.1743308608851257 86E+01
9	.5163915358253131 89E+00	.1743308608851257 86E+01
10	.5163915358253131 89E+00	.1743308608851257 86E+01
11	.5163915358253131 89E+00	.1743308608851257 86E+01
12	.5163915358253131 89E+00	.1743308608851257 86E+01
13	.5163915358253131 89E+00	.1743308608851257 86E+01
14	.5163915358253131 89E+00	.1743308608851257 86E+01
15	.5163915358253131 89E+00	.1743308608851257 86E+01
16	.5163915358253131 89E+00	.1743308608851257 86E+01
17	.5163915358253131 89E+00	.1743308608851257 86E+01
18	.5163915358253131 89E+00	.1743308608851257 86E+01
19	.5163915358253131 89E+00	.1743308608851257 86E+01
20	.5163915358253131 89E+00	.1743308608851257 86E+01
21	.5163915358253131 89E+00	.1743308608851257 86E+01
22	.5163915358253131 89E+00	.1743308608851257 86E+01
23	.5163915358253131 89E+00	.1743308608851257 86E+01
24	.5163915358253131 89E+00	.1743308608851257 86E+01
25	.5163915358253131 89E+00	.1743308608851257 86E+01
26	.5163915358253131 89E+00	.1743308608851257 86E+01
27	.5163915358253131 89E+00	.1743308608851257 86E+01
28	.5163915358253131 89E+00	.1743308608851257 86E+01
29	.5163915358253131 89E+00	.1743308608851257 86E+01
30	.5163915358253131 89E+00	.1743308608851257 86E+01
31	.5163915358253131 89E+00	.1743308608851257 86E+01
32	.5163915358253131 89E+00	.1743308608851257 86E+01
33	.5163915358253131 89E+00	.1743308608851257 86E+01
34	.5163915358253131 89E+00	.1743308608851257 86E+01
35	.5163915358253131 89E+00	.1743308608851257 86E+01
36	.5163915358253131 89E+00	.1743308608851257 86E+01
37	.5163915358253131 89E+00	.1743308608851257 86E+01
38	.5163915358253131 89E+00	.1743308608851257 86E+01
39	.5163915358253131 89E+00	.1743308608851257 86E+01
40	.5163915358253131 89E+00	.1743308608851257 86E+01
41	.5163915358253131 89E+00	.1743308608851257 86E+01
42	.5163915358253131 89E+00	.1743308608851257 86E+01
43	.5163915358253131 89E+00	.1743308608851257 86E+01
44	.5163915358253131 89E+00	.1743308608851257 86E+01
45	.5163915358253131 89E+00	.1743308608851257 86E+01
46	.5163915358253131 89E+00	.1743308608851257 86E+01
47	.5163915358253131 89E+00	.1743308608851257 86E+01
48	.5163915358253131 89E+00	.1743308608851257 86E+01
49	.5163915358253131 89E+00	.1743308608851257 86E+01
50	.5163915358253131 89E+00	.1743308608851257 86E+01

PUV (COS THETA) = .5826854510897394 38E+00
QUV (COS THETA) = .3089934057075149 95E+01

MU = -.50 NU = 1.50 THETA = 30.0 DEGREES

K	PSP	QSP
1	.43301270189221876 9E+00	.24999999999999680E+00
2	.43301270189221876 9E+00	.24999999999999680E+00
3	.43301270189221876 9E+00	.24999999999999680E+00
4	.43301270189221876 9E+00	.24999999999999680E+00
5	.43301270189221876 9E+00	.24999999999999680E+00
6	.43301270189221876 9E+00	.24999999999999680E+00
7	.43301270189221876 9E+00	.24999999999999680E+00
8	.43301270189221876 9E+00	.24999999999999680E+00
9	.43301270189221876 9E+00	.24999999999999680E+00
10	.43301270189221876 9E+00	.24999999999999680E+00
11	.43301270189221876 9E+00	.24999999999999680E+00
12	.43301270189221876 9E+00	.24999999999999680E+00
13	.43301270189221876 9E+00	.24999999999999680E+00
14	.43301270189221876 9E+00	.24999999999999680E+00
15	.43301270189221876 9E+00	.24999999999999680E+00
16	.43301270189221876 9E+00	.24999999999999680E+00
17	.43301270189221876 9E+00	.24999999999999680E+00
18	.43301270189221876 9E+00	.24999999999999680E+00
19	.43301270189221876 9E+00	.24999999999999680E+00
20	.43301270189221876 9E+00	.24999999999999680E+00
21	.43301270189221876 9E+00	.24999999999999680E+00
22	.43301270189221876 9E+00	.24999999999999680E+00
23	.43301270189221876 9E+00	.24999999999999680E+00
24	.43301270189221876 9E+00	.24999999999999680E+00
25	.43301270189221876 9E+00	.24999999999999680E+00
26	.43301270189221876 9E+00	.24999999999999680E+00
27	.43301270189221876 9E+00	.24999999999999680E+00
28	.43301270189221876 9E+00	.24999999999999680E+00
29	.43301270189221876 9E+00	.24999999999999680E+00
30	.43301270189221876 9E+00	.24999999999999680E+00
31	.43301270189221876 9E+00	.24999999999999680E+00
32	.43301270189221876 9E+00	.24999999999999680E+00
33	.43301270189221876 9E+00	.24999999999999680E+00
34	.43301270189221876 9E+00	.24999999999999680E+00
35	.43301270189221876 9E+00	.24999999999999680E+00
36	.43301270189221876 9E+00	.24999999999999680E+00
37	.43301270189221876 9E+00	.24999999999999680E+00
38	.43301270189221876 9E+00	.24999999999999680E+00
39	.43301270189221876 9E+00	.24999999999999680E+00
40	.43301270189221876 9E+00	.24999999999999680E+00
41	.43301270189221876 9E+00	.24999999999999680E+00
42	.43301270189221876 9E+00	.24999999999999680E+00
43	.43301270189221876 9E+00	.24999999999999680E+00
44	.43301270189221876 9E+00	.24999999999999680E+00
45	.43301270189221876 9E+00	.24999999999999680E+00
46	.43301270189221876 9E+00	.24999999999999680E+00
47	.43301270189221876 9E+00	.24999999999999680E+00
48	.43301270189221876 9E+00	.24999999999999680E+00
49	.43301270189221876 9E+00	.24999999999999680E+00
50	.43301270189221876 9E+00	.24999999999999680E+00

PUV (COS THETA) = .48860251190291929 6E+00
QUV (COS THETA) = .44311346272637844 0E+00

MU = 0.00 NU =-1.50 THETA = 30.0 DEGREES

K	PSP	QSP
1	.917489626359302134-100	-.342411790099030102E-99
2	.626657068657749328E+00	.626657068657749328E+00
3	.947668121875589847E+00	.540642416186564807E+00
4	.100142727967008017E+01	.340010507925414482E+00
5	.894332565788140590E+00	.232915794043474900E+00
6	.779125962216308178E+00	.263785310433279892E+00
7	.753658611947190 59E+00	.358830758380041632E+00
8	.812882824648883851E+00	.418054971834206424E+00
9	.883310713573082701E+00	.399183875872338531E+00
10	.900019496455986565E+00	.336825849220704133E+00
11	.859061980519042225E+00	.295868333283759793E+00
12	.808326403493899003E+00	.309462890175173943E+00
13	.795890473610275832E+00	.355874412340219731E+00
14	.827198110728573917E+00	.387182049458517815E+00
15	.866851604759261251E+00	.376556927755922800E+00
16	.876755736060608748E+00	.339594206534460678E+00
17	.851416494041668073E+00	.314254964515520003E+00
18	.818870380602645191E+00	.322975669328277894E+00
19	.810641284149430024E+00	.353687075392061741E+00
20	.831923879869961048E+00	.374969671112592765E+00
21	.859523691273615018E+00	.367574323935732393E+00
22	.866562477068733908E+00	.341305217724754597E+00
23	.848216668143864184E+00	.322959408799884872E+00
24	.824257810722514346E+00	.329379165297507972E+00
25	.818108451577372654E+00	.352328886061165086E+00
26	.834229798580473077E+00	.368450233064265509E+00
27	.855396491543588001E+00	.362778634778361337E+00
28	.860856010833758577E+00	.342403431402542377E+00
29	.846477962186382571E+00	.328025382755166371E+00
30	.827520497781139502E+00	.333105020033093005E+00
31	.822611641411694885E+00	.351425121410918418E+00
32	.835586660439964369E+00	.364400140439187903E+00
33	.852752517836254587E+00	.359800562812464124E+00
34	.857211625407616772E+00	.343158946799725384E+00
35	.845390140500710601E+00	.331337461892819213E+00
36	.829706468587040199E+00	.335539889116441878E+00
37	.825621609267887930E+00	.350784791637289358E+00
38	.836477935077645114E+00	.361641117447046543E+00
39	.850915051408049128E+00	.357772703785280614E+00
40	.854683622409516442E+00	.343708205335873870E+00
41	.844646743136148566E+00	.333671326062505994E+00
42	.831272606769438022E+00	.337254915101429794E+00
43	.827774861544599941E+00	.350308677992456940E+00
44	.837107323426516310E+00	.359641139874373310E+00
45	.849564283016632612E+00	.356303307612054517E+00
46	.852827519785210189E+00	.344124742194596117E+00
47	.844107079359209491E+00	.335404301768595419E+00
48	.832449567782752861E+00	.338527922581263437E+00
49	.829391368549605483E+00	.349941277499037630E+00
50	.837575122762385681E+00	.358125031711817828E+00

PUV (COS THETA) = .945102319402542450E+00
QUV (COS THETA) = .634760091563271556E+00

MU = 0.00 NU = -.40 THETA = 30.0 DEGREES

K	PSP	QSP
1	.4837182323813128 15E+00	.1488731640431480 02E+01
2	.9013014695327669 85E+00	.1577491697531430 57E+01
3	.1064535802598847 89E+01	.1396201604378444 38E+01
4	.1011847599658277 58E+01	.1234043989584902 36E+01
5	.8837142696118046 24E+00	.1206808409514893 93E+01
6	.8125603581024380 76E+00	.1285832834116245 36E+01
7	.8402132069237954 22E+00	.1370939551689732 97E+01
8	.9157681378228082 03E+00	.1386999248018843 25E+01
9	.9612322970128087 59E+00	.1336506183846241 97E+01
10	.9424921019177314 45E+00	.1278829793918670 08E+01
11	.8889285211473014 82E+00	.1267444503359372 97E+01
12	.8555278184453815 87E+00	.1304539741784214 45E+01
13	.8696993336135501 90E+00	.1348155180714116 35E+01
14	.9111855879993260 50E+00	.1356973356302924 74E+01
15	.9375814747104364 04E+00	.1327657754181552 00E+01
16	.9261878902441186 56E+00	.1292591906840150 17E+01
17	.8923352267621526 56E+00	.1285396301087051 16E+01
18	.8705156488205118 14E+00	.1309629397417328 48E+01
19	.8800417995988267 29E+00	.1338947874840397 52E+01
20	.9086333157343252 35E+00	.1345025189203092 04E+01
21	.9272288352614942 43E+00	.1324372772496467 51E+01
22	.9190442040282068 46E+00	.1299183067691928 49E+01
23	.8942985804052619 81E+00	.1293923223018254 86E+01
24	.8780970497968917 09E+00	.1311916845671299 11E+01
25	.8852713425669363 33E+00	.1333997048420540 89E+01
26	.9070829959083543 04E+00	.1338633258459131 15E+01
27	.9214366137221938 55E+00	.1322691950882005 70E+01
28	.9150506374171943 01E+00	.1303037936739317 32E+01
29	.8955509900633781 19E+00	.1298893158744012 21E+01
30	.8826669174214881 19E+00	.1313202371062063 66E+01
31	.8884206624200543 86E+00	.1330910577321255 51E+01
32	.9060514544774677 08E+00	.1334658117860498 43E+01
33	.9177389363458974 21E+00	.1321677854230581 11E+01
34	.9125035173258654 15E+00	.1305564891302414 40E+01
35	.8964146946633739 98E+00	.1302145106475956 50E+01
36	.8857204331745964 34E+00	.1314022287122248 73E+01
37	.8905231935207038 98E+00	.1328803663572461 80E+01
38	.9053180672295762 74E+00	.1331948411058361 92E+01
39	.9151746938165739 56E+00	.1321001518216844 14E+01
40	.9107385415698393 00E+00	.1307348445478665 88E+01
41	.8970449809081256 18E+00	.1304437789307392 14E+01
42	.8879043058725337 06E+00	.1314589537395907 30E+01
43	.8920258483433246 74E+00	.1327274340806029 28E+01
44	.9047706949488130 94E+00	.1329983341579503 75E+01
45	.9132923822548604 03E+00	.1320519049009946 54E+01
46	.9094437813542621 53E+00	.1308674273377017 45E+01
47	.8975247108343782 41E+00	.1306140796729008 41E+01
48	.8895434961118384 89E+00	.1315004833683400 06E+01
49	.8931530598289203 10E+00	.1326113928511847 89E+01
50	.9043468504224545 78E+00	.1328493242152463 77E+01

PUV (COS THETA) = .1020446145845139 39E+01
QUV (COS THETA) = .2354692962955088 63E+01

MU = 0.00 NU = .05 THETA = 30.0 DEGREES

K	PSP	QSP
1	.5722496281461356 28E+00	.9338265211490939 18E+00
2	.9430833117982714 30E+00	.9241158993937664 13E+00
3	.1049808239219975 99E+01	.7275530352544371 01E+00
4	.9661365939788890 83E+00	.5910133198029278 67E+00
5	.8414568106039758 45E+00	.5942781748316465 61E+00
6	.7927209440614012 62E+00	.6840384749353725 13E+00
7	.8379061646108771 92E+00	.7577740533223212 63E+00
8	.9128645009825010 54E+00	.7558112002051371 89E+00
9	.9444599928903461 2E+00	.6976453160868487 24E+00
10	.9134948660842590 05E+00	.6471376571480877 49E+00
11	.8599053528106607 53E+00	.6485409479396010 95E+00
12	.8365455878234630 39E+00	.6915642829976055 80E+00
13	.8600825595071694 95E+00	.7299731299495645 09E+00
14	.9017843318298882 04E+00	.7288811306102257 06E+00
15	.9203190217798974 19E+00	.6947444782786418 05E+00
16	.9013305341714694 89E+00	.6637580827388045 72E+00
17	.8671998353508406 69E+00	.6646518265412230 99E+00
18	.8518381376401526 50E+00	.6929445541448151 17E+00
19	.8677514376637660 77E+00	.7189126996361352 96E+00
20	.8966377862267625 21E+00	.7181562839782444 76E+00
21	.9097540929127640 59E+00	.6939990521916808 53E+00
22	.8960587422996434 86E+00	.6716502711878397 41E+00
23	.8710197392782389 19E+00	.6723059405571288 76E+00
24	.8595761178613783 87E+00	.6933824693134915 55E+00
25	.8715961571418026 18E+00	.7129973906926061 59E+00
26	.8936922170722392 81E+00	.7124187850002796 90E+00
27	.9038415295255887 78E+00	.6937260768104437 77E+00
28	.8931316003456195 22E+00	.6762490608090810 91E+00
29	.8733594426594615 30E+00	.6767668129795044 21E+00
30	.8642414061272524 48E+00	.6935601472023165 81E+00
31	.8738987467847436 26E+00	.7093194948474210 14E+00
32	.8917893089943307 19E+00	.7088510139885721 07E+00
33	.9000663165909231 18E+00	.6936066623736904 60E+00
34	.8912731780764708 77E+00	.6792575644537244 32E+00
35	.8749372083534608 90E+00	.6796853368756477 83E+00
36	.8673591815558854 49E+00	.6936423260050035 92E+00
37	.8754300836122817 14E+00	.7068128411423850 55E+00
38	.8904600337290102 88E+00	.7064192680474396 09E+00
39	.8974479426839053 95E+00	.6935491407800613 11E+00
40	.8899896381711101 89E+00	.6813782939777361 89E+00
41	.8760723401223011 50E+00	.6817427312528973 01E+00
42	.8695892810800362 37E+00	.6936830406493767 71E+00
43	.8765214225811374 50E+00	.7049952674533642 86E+00
44	.8894794513805656 74E+00	.7046559495275311 93E+00
45	.8955256926682116 42E+00	.6935201583540114 02E+00
46	.8890503674402083 41E+00	.6829533879559866 01E+00
47	.8769278965173588 08E+00	.6832708260287970 88E+00
48	.8712633245154955 87E+00	.6937036698236690 32E+00
49	.8773383182129391 58E+00	.7036171585381390 87E+00
50	.8887264607434396 80E+00	.7033189495310166 79E+00

PUV (COS THETA) = .1002820423549425 22E+01

QUV (COS THETA) = .1246600380511072 79E+01

MU = 0.00 NU = 1.50 THETA = 30.0 DEGREES

K	PSP	QSP
1	.64202210643568103E+00	.17202930494236904E+00
2	.83785244039122770 3E+00	-.23801029013177622 7E-01
3	.79081317732104866 8E+00	-.19935394874168415 7E+00
4	.65914848752466876 8E+00	-.23463339604431843 3E+00
5	.58183949094114363 2E+00	-.15732439946079329 7E+00
6	.60548774546119067 0E+00	-.69067912081657394 8E-01
7	.68133316430263558 6E+00	-.48745193353491971 2E-01
8	.73002569098928148 9E+00	-.97437720040137874 0E-01
9	.71415234725052281 8E+00	-.15667784535919055 3E+00
10	.66074647669774048 0E+00	-.17098790524488965 7E+00
11	.62515299906958345 2E+00	-.13539442761673262 9E+00
12	.63711062395768265 5E+00	-.90767963996496294 5E-01
13	.67835025774959748 2E+00	-.79717837425797477 9E-01
14	.70641101766675338 9E+00	-.10777859734295338 5E+00
15	.69681639046857300 1E+00	-.14358623352624481 5E+00
16	.66322040240248486 5E+00	-.15258825139747876 7E+00
17	.64005681068250501 3E+00	-.12942465967749891 5E+00
18	.64806935196589872 8E+00	-.99521448510130432 7E-01
19	.67641510421830010 2E+00	-.91926227085246807 0E-01
20	.69613850977302718 5E+00	-.11164963263997389 0E+00
21	.68925969638234281 5E+00	-.13732171370979310 0E+00
22	.66474365623026391 1E+00	-.14389076687015162 1E+00
23	.64756995324244814 7E+00	-.12671706388233585 7E+00
24	.65359632520468700 6E+00	-.10422633753395188 5E+00
25	.67519499149357978 6E+00	-.98438992344253750 8E-01
26	.69040313997306441 3E+00	-.11364714082373837 8E+00
27	.68504111209878974 1E+00	-.13365850128213200 0E+00
28	.66573896652254225 3E+00	-.13883049560147548 2E+00
29	.65209243651401442 6E+00	-.12518396559294765 5E+00
30	.65692211778072606 6E+00	-.10715934972121620 0E+00
31	.67436938267531612 3E+00	-.10248436918257891 7E+00
32	.68674526426655579 8E+00	-.11486025077381859 2E+00
33	.68235173180653717 4E+00	-.13125713713931117 4E+00
34	.66643397523743885 5E+00	-.13552228715731626 7E+00
35	.65511219227919733 6E+00	-.12420050419907474 9E+00
36	.65914185079673944 0E+00	-.10916161387445493 7E+00
37	.67377673584399830 3E+00	-.10524020824471961 2E+00
38	.68420994232457692 4E+00	-.11567341472529823 3E+00
39	.68048847846062795 1E+00	-.12956210694408739 3E+00
40	.66694504922851600 8E+00	-.13319105786957984 8E+00
41	.65727105603558386 8E+00	-.12351706467664770 8E+00
42	.66072812980431918 1E+00	-.11061508972621390 1E+00
43	.67333164186020155 8E+00	-.10723798884904429 9E+00
44	.68234944555102353 9E+00	-.11625579253986628 1E+00
45	.67912167874732180 6E+00	-.12830198224626535 0E+00
46	.66733606264804697 1E+00	-.13145992856236928 0E+00
47	.65889106657971449 1E+00	-.12301493249403680 0E+00
48	.66191805969823791 6E+00	-.11171804038154601 7E+00
49	.67298548368969373 1E+00	-.10875253306074259 9E+00
50	.68092610770153662 0E+00	-.11669315707258548 9E+00

PUV (COS THETA) = .76834283426184918 2E+00

QUV (COS THETA) = -.20683323562762640 3E+00

MU = .50 NU =-1.50 THETA = 30.0 DEGREES

K	PSP	QSP
1	0.	.99999999999998720E+00
2	.86602540378443753 8E+00	.14999999999999808E+01
3	.17320508075688750 8E+01	.99999999999998720E+00
4	.17320508075688750 8E+01	.25243548967072377 8E-28
5	.86602540378443753 8E+00	-.49999999999999360E+00
6	.25243548967072377 8E-28	-.35340968553901328 9E-27
7	-.27767903863779576 8E-27	.99999999999998720E+00
8	.86602540378443753 8E+00	.14999999999999808E+01
9	.17320508075688750 8E+01	.99999999999998720E+00
10	.17320508075688750 8E+01	-.10097419586828951 1E-27
11	.86602540378443753 8E+00	-.49999999999999360E+00
12	.11359597035182570 0E-27	-.83303711591338846 7E-27
13	-.49224920485791059 1E-27	.99999999999998720E+00
14	.86602540378443753 8E+00	.14999999999999808E+01
15	.17320508075688750 8E+01	.99999999999998720E+00
16	.17320508075688750 8E+01	.22719194070365140 0E-27
17	.86602540378443753 8E+00	-.49999999999999360E+00
18	-.12621774483536188 9E-27	-.49224920485791136 7E-27
19	-.93401131178167694 3E-27	.99999999999998720E+00
20	.86602540378443753 8E+00	.14999999999999808E+01
21	.17320508075688750 8E+01	.99999999999998720E+00
22	.17320508075688750 8E+01	.83303711591338846 7E-27
23	.86602540378443753 8E+00	-.49999999999999360E+00
24	.27767903863779615 6E-27	-.56797985175912850 0E-27
25	-.93401131178167642 6E-27	.99999999999998720E+00
26	.86602540378443753 8E+00	.14999999999999808E+01
27	.17320508075688750 8E+01	.99999999999998720E+00
28	.17320508075688750 8E+01	.11864468014524017 6E-26
29	.86602540378443753 8E+00	-.49999999999999360E+00
30	-.12621774483536188 9E-27	-.59322340072620878 E-27
31	-.13379080952548344 7E-26	.99999999999998720E+00
32	.86602540378443753 8E+00	.14999999999999808E+01
33	.17320508075688750 8E+01	.99999999999998720E+00
34	.17320508075688750 8E+01	.15651000359584874 2E-26
35	.86602540378443753 8E+00	-.49999999999999360E+00
36	-.16913177807938493 1E-26	.16408306828597045 6E-27
37	-.33069049146864794 2E-26	.99999999999998720E+00
38	.86602540378443753 8E+00	.14999999999999808E+01
39	.17320508075688750 8E+01	.99999999999998720E+00
40	.17320508075688750 8E+01	.29282516801803958 2E-26
41	.86602540378443753 8E+00	-.49999999999999360E+00
42	-.17165613297609216 9E-26	-.13000427718042274 6E-26
43	-.41399420305998668 5E-26	.99999999999998720E+00
44	.86602540378443753 8E+00	.14999999999999808E+01
45	.17320508075688750 8E+01	.99999999999998720E+00
46	.17320508075688750 8E+01	.75730646901217133 3E-28
47	.86602540378443753 8E+00	-.49999999999999360E+00
48	-.25748419946413825 3E-26	-.27515468374108891 8E-26
49	-.49982226954803277 0E-26	.99999999999998720E+00
50	.86602540378443753 8E+00	.14999999999999808E+01

PUV (COS THETA) = .97720502380583859 2E+00

QUV (COS THETA) = .26586807763582706 4E+01

MU = .50 NU = -.40 THETA = 30.0 DEGREES

K	PSP	QSP
1	.544639035015026385E+00	.838670567945422956E+00
2	.154326856976959898E+01	.786334611702479190E+00
3	.199725906950914519E+01	-.104671912485887531E+00
4	.145262003449411881E+01	-.943342480431310487E+00
5	.453990499739546210E+00	-.891006524188366722E+00
6	-.126217744835361889E-28	-.391275008989621855E-27
7	.544639035015026385E+00	.838670567945422956E+00
8	.154326856976959898E+01	.786334611702479190E+00
9	.199725906950914519E+01	-.104671912485887531E+00
10	.145262003449411881E+01	-.943342480431310487E+00
11	.453990499739546210E+00	-.891006524188366722E+00
12	.252435489670723778E-27	-.164083068285970456E-26
13	.544639035015026385E+00	.838670567945422956E+00
14	.154326856976959898E+01	.786334611702479190E+00
15	.199725906950914519E+01	-.104671912485887531E+00
16	.145262003449411881E+01	-.943342480431310487E+00
17	.453990499739546210E+00	-.891006524188366722E+00
18	.555358077275592311E-27	-.209521456426700736E-26
19	.544639035015026385E+00	.838670567945422956E+00
20	.154326856976959898E+01	.786334611702479190E+00
21	.199725906950914519E+01	-.104671912485887531E+00
22	.145262003449411881E+01	-.943342480431310487E+00
23	.453990499739546210E+00	-.891006524188366722E+00
24	.908767762814605600E-27	-.315544362088404722E-26
25	.544639035015026385E+00	.838670567945422956E+00
26	.154326856976959898E+01	.786334611702479190E+00
27	.199725906950914519E+01	-.104671912485887531E+00
28	.145262003449411881E+01	-.943342480431310487E+00
29	.453990499739546210E+00	-.891006524188366722E+00
30	.164083068285970456E-26	-.283989925879564250E-26
31	.544639035015026385E+00	.838670567945422956E+00
32	.154326856976959898E+01	.786334611702479190E+00
33	.199725906950914519E+01	-.104671912485887531E+00
34	.145262003449411881E+01	-.943342480431310487E+00
35	.453990499739546210E+00	-.891006524188366722E+00
36	.194375327046457309E-26	-.386226299196207380E-26
37	.544639035015026385E+00	.838670567945422956E+00
38	.154326856976959898E+01	.786334611702479190E+00
39	.199725906950914519E+01	-.104671912485887531E+00
40	.145262003449411881E+01	-.943342480431310487E+00
41	.453990499739546210E+00	-.891006524188366722E+00
42	.132528632077129983E-26	-.959254860748750355E-27
43	.544639035015026385E+00	.838670567945422956E+00
44	.154326856976959898E+01	.786334611702479190E+00
45	.199725906950914519E+01	-.104671912485887531E+00
46	.145262003449411881E+01	-.943342480431310487E+00
47	.453990499739546210E+00	-.891006524188366722E+00
48	.116120325248532938E-26	-.260008554360845491E-26
49	.544639035015026385E+00	.838670567945422956E+00
50	.154326856976959898E+01	.786334611702479190E+00

PUV (COS THETA) = .174139210336130303E+01
QUV (COS THETA) = .139374181061235289E+01

MU = .50 NU = .05 THETA = 30.0 DEGREES

K	PSP	QSP
1	.725374371012286709E+00	.688354575693753103E+00
2	.168419410588047853E+01	.404339230989830849E+00
3	.191763946973638364E+01	-.568030689407844508E+00
4	.119226509872409694E+01	-.125638526510159761E+01
5	.233445363855905113E+00	-.972369920397675357E+00
6	-.435451219681998517E-27	-.504870979341447555E-27
7	.725374371012286709E+00	.688354575693753103E+00
8	.168419410588047853E+01	.404339230989830849E+00
9	.191763946973638364E+01	-.568030689407844508E+00
10	.119226509872409694E+01	-.125638526510159761E+01
11	.233445363855905113E+00	-.972369920397675357E+00
12	-.580601626242664689E-27	-.757306469012171333E-27
13	.725374371012286709E+00	.688354575693753103E+00
14	.168419410588047853E+01	.404339230989830849E+00
15	.191763946973638364E+01	-.568030689407844508E+00
16	.119226509872409694E+01	-.125638526510159761E+01
17	.233445363855905113E+00	-.972369920397675357E+00
18	-.176704842769506644E-26	-.143888229112312553E-26
19	.725374371012286709E+00	.688354575693753103E+00
20	.168419410588047853E+01	.404339230989830849E+00
21	.191763946973638364E+01	-.568030689407844508E+00
22	.119226509872409694E+01	-.125638526510159761E+01
23	.233445363855905113E+00	-.972369920397675357E+00
24	-.277047949913619346E-26	-.229716295600358638E-26
25	.725374371012286709E+00	.688354575693753103E+00
26	.168419410588047853E+01	.404339230989830849E+00
27	.191763946973638364E+01	-.568030689407844508E+00
28	.119226509872409694E+01	-.125638526510159761E+01
29	.233445363855905113E+00	-.972369920397675357E+00
30	-.283989925879564250E-26	-.381177589402792904E-26
31	.725374371012286709E+00	.688354575693753103E+00
32	.168419410588047853E+01	.404339230989830849E+00
33	.191763946973638364E+01	-.568030689407844508E+00
34	.119226509872409694E+01	-.125638526510159761E+01
35	.233445363855905113E+00	-.972369920397675357E+00
36	-.381808678126969714E-26	-.482151785271082415E-26
37	.725374371012286709E+00	.688354575693753103E+00
38	.168419410588047853E+01	.404339230989830849E+00
39	.191763946973638364E+01	-.568030689407844508E+00
40	.119226509872409694E+01	-.125638526510159761E+01
41	.233445363855905113E+00	-.972369920397675357E+00
42	-.425353800095169565E-26	-.633613079073516682E-26
43	.725374371012286709E+00	.688354575693753103E+00
44	.168419410588047853E+01	.404339230989830849E+00
45	.191763946973638364E+01	-.568030689407844508E+00
46	.119226509872409694E+01	-.125638526510159761E+01
47	.233445363855905113E+00	-.972369920397675357E+00
48	-.320593071881819198E-26	-.744684694528635144E-26
49	.725374371012286709E+00	.688354575693753103E+00
50	.168419410588047853E+01	.404339230989830849E+00

PUV (COS THETA) = .190040954242058588E+01

QUV (COS THETA) = .716672627040100654E+00

MU = .50 NU = 1.50 THETA = 30.0 DEGREES

K	PSP	QSP
1	.99999999999998720E+00	.75730646901217036 4E-28
2	.14999999999999808E+01	-.86602540378443753 8E+00
3	.99999999999998720E+00	-.17320508075688750 8E+01
4	.20194839173657902 2E-27	-.17320508075688750 8E+01
5	-.49999999999999360E+00	-.86602540378443753 8E+00
6	-.31554436208840472 2E-27	.25243548967072377 8E-28
7	.99999999999998720E+00	.32816613657194052 3E-27
8	.14999999999999808E+01	-.86602540378443753 8E+00
9	.99999999999998720E+00	-.17320508075688750 8E+01
10	.40389678347315804 4E-27	-.17320508075688750 8E+01
11	-.49999999999999360E+00	-.86602540378443753 8E+00
12	-.64371049866034563 3E-27	-.25243548967072377 8E-27
13	.99999999999998720E+00	.15146129380243375 0E-27
14	.14999999999999808E+01	-.86602540378443753 8E+00
15	.99999999999998720E+00	-.17320508075688750 8E+01
16	.20194839173657902 2E-27	-.17320508075688750 8E+01
17	-.49999999999999360E+00	-.86602540378443753 8E+00
18	-.12243121249030103 2E-26	.32816613657194091 1E-27
19	.99999999999998720E+00	.11359597035182559 7E-26
20	.14999999999999808E+01	-.86602540378443753 8E+00
21	.99999999999998720E+00	-.17320508075688750 8E+01
22	.20194839173657902 2E-27	-.17320508075688750 8E+01
23	-.49999999999999360E+00	-.86602540378443753 8E+00
24	-.19311314959810369 0E-26	.68157582211095420 0E-27
25	.99999999999998720E+00	.14893693890572692 5E-26
26	.14999999999999808E+01	-.86602540378443753 8E+00
27	.99999999999998720E+00	-.17320508075688750 8E+01
28	.12621774483536188 9E-27	-.17320508075688750 8E+01
29	-.49999999999999360E+00	-.86602540378443753 8E+00
30	-.20068621428822540 3E-26	.11107161545511846 2E-26
31	.99999999999998720E+00	.27263032884438147 3E-26
32	.14999999999999808E+01	-.86602540378443753 8E+00
33	.99999999999998720E+00	-.17320508075688750 8E+01
34	-.55535807727559231 1E-27	-.17320508075688750 8E+01
35	-.49999999999999360E+00	-.86602540378443753 8E+00
36	-.33826355615876986 2E-26	.27263032884438168 0E-26
37	.99999999999998720E+00	.43418904223364469 1E-26
38	.14999999999999808E+01	-.86602540378443753 8E+00
39	.99999999999998720E+00	-.17320508075688750 8E+01
40	-.55535807727559231 1E-27	-.17320508075688750 8E+01
41	-.49999999999999360E+00	-.86602540378443753 8E+00
42	-.47836525292602155 9E-26	.27767903863779615 6E-26
43	.99999999999998720E+00	.35845839533242766 1E-26
44	.14999999999999808E+01	-.86602540378443753 8E+00
45	.99999999999998720E+00	-.17320508075688750 8E+01
46	-.19185097214975007 1E-26	-.17320508075688750 8E+01
47	-.49999999999999360E+00	-.86602540378443753 8E+00
48	-.61341823989985878 0E-26	.20699710152999349 8E-26
49	.99999999999998720E+00	.36855581491925650 9E-26
50	.14999999999999808E+01	-.86602540378443753 8E+00

PUV (COS THETA) = .16925687506432666 9E+01
QUV (COS THETA) = -.15349900619197307 7E+01

MU = 1.00 NU =-1.50 THETA = 30.0 DEGREES

K	PSP	QSP
1	.4587448131796510 92-100	.171205895049515060E-99
2	.128404421287136208E+01	.344058609884738085E+00
3	.304651721847128206E+01	-.141841439571518190E+01
4	.210573195706770136E+01	-.492947279028531258E+01
5	-.250253218580559515E+01	-.616425344587751225E+01
6	-.667721800131595250E+01	-.198956763036715490E+01
7	-.485630240327233055E+01	.480618189782630955E+01
8	.303162115623794069E+01	.691974464555551360E+01
9	.960511225893513772E+01	.346253542858316574E+00
10	.690664382334616377E+01	-.972456776138063860E+01
11	-.425518312218534476E+01	-.127153702774917514E+02
12	-.132247394844809157E+02	-.374581391519618043E+01
13	-.964940964293925416E+01	.959749870725448356E+01
14	.478446218423093526E+01	.134650430069990693E+02
15	.161490699506790776E+02	.210043524055092697E+01
16	.116971629307233777E+02	-.145143079484962967E+02
17	-.600792278010507000E+01	-.192583713666365894E+02
18	-.197670962617731023E+02	-.549919788496855717E+01
19	-.144387563083162818E+02	.143864375413314837E+02
20	.653710035846073500E+01	.200069013957453667E+02
21	.226905695077822159E+02	.385343224642388580E+01
22	.164858798293849142E+02	-.193027848785530413E+02
23	-.776048388102112145E+01	-.257995784541476185E+02
24	-.263080831078621465E+02	-.725197922730659346E+01
25	-.192270960522314879E+02	.191746242320445727E+02
26	.828960479981791393E+01	.265477020037199960E+02
27	.292312252560682462E+02	.560608154746966378E+01
28	.212739758906446323E+02	-.240907773727864710E+02
29	-.951294630347011067E+01	-.323401083121393248E+02
30	-.328485126180526948E+02	-.900454199755674062E+01
31	-.240150255812371049E+02	.239624804318400908E+02
32	.100420354930026864E+02	.330880424432600672E+02
33	.357714933211899700E+02	.735858461507278359E+01
34	.260617865845488105E+02	-.288785342526658239E+02
35	-.112653525699867471E+02	-.388803110448877670E+02
36	-.393886614382586794E+02	-.107570021766158347E+02
37	-.288027485126755739E+02	.287501627061604107E+02
38	.117944226084205117E+02	.396281419230462033E+02
39	.423115515641129800E+02	.911101296735373496E+01
40	.308494428631501429E+02	-.336661590665168762E+02
41	-.130177244196604406E+02	-.454203311141869394E+02
42	-.459286492620155805E+02	-.125094062718317995E+02
43	-.335903529813992478E+02	.335377423262664600E+02
44	.135467821076008393E+02	.461680996068807707E+02
45	.488514835571688979E+02	.108633981573127122E+02
46	.356370062628139997E+02	-.384537025006850782E+02
47	-.147700737937844664E+02	-.519602388946615882E+02
48	-.524685362428206577E+02	-.142617764456253969E+02
49	-.383778832760941133E+02	.383252563380191995E+02
50	.152991230824665860E+02	.527079668439157774E+02

PUV (COS THETA) = .172632117610853773E+02

QUV (COS THETA) = .934222438805898776E+02

MU = 1.00 NU = -.40 THETA = 30.0 DEGREES

K	PSP	QSP
1	.697966858638996821E+00	.628452182304411485E+00
2	.264685191520384340E+01	-.477895826748892819E-02
3	.330621233937490457E+01	-.310682586282114848E+01
4	.113167472873922047E+00	-.598185637424308958E+01
5	-.504463119669334992E+01	-.430598599729680318E+01
6	-.640653836762939488E+01	.210128348540353387E+01
7	-.700715814937718649E+00	.723882918789294411E+01
8	.767399068334997784E+01	.451772209642955912E+01
9	.973929737145194587E+01	-.519878193372218645E+01
10	.151895254164084976E+01	-.126004136640069362E+02
11	-.100740703602049736E+02	-.883361218431806506E+01
12	-.128429842137007813E+02	.419310330139032513E+01
13	-.210759155632982071E+01	.138592942672124732E+02
14	.127042422373985797E+02	.904663773030194484E+01
15	.161768451448643877E+02	-.729067446642411825E+01
16	.292617745455907570E+01	-.192216292444217389E+02
17	-.151046975834117967E+02	-.133630428042707498E+02
18	-.192810301328327556E+02	.628505705493000789E+01
19	-.351496873472032399E+01	.204808825004384981E+02
20	.177350733962494942E+02	.135763252663073233E+02
21	.226151586436168846E+02	-.938267072527891218E+01
22	.433363378184129352E+01	-.258434296467531638E+02
23	-.201356516824096159E+02	-.178928768466724881E+02
24	-.257195039759758281E+02	.837708278051943836E+01
25	-.492247118047054962E+01	.271028152189872032E+02
26	.227661072895875395E+02	.181062507133749387E+02
27	.290537361637662649E+02	-.114747174053124079E+02
28	.574116534857742675E+01	-.324654504502882291E+02
29	-.251667402897762156E+02	-.224228631390790310E+02
30	-.321581524016316397E+02	.104691447901283438E+02
31	-.633002226599230782E+01	.337248976209089156E+02
32	.277972350408346169E+02	.226362795435124783E+02
33	.354924352219128022E+02	-.135667909268520052E+02
34	.714873013361451158E+01	-.390875776187410508E+02
35	-.301978970090111233E+02	-.269529228722355151E+02
36	-.385968888768366575E+02	.125612271584011747E+02
37	-.773759702494758409E+01	.403470583460094752E+02
38	.328284137971896357E+02	.271663624322998591E+02
39	.419312001305265578E+02	-.156588802316660016E+02
40	.855631237385581825E+01	-.457097641457587982E+02
41	-.352290929189087573E+02	-.314830235585990435E+02
42	-.450356758984390048E+02	.146533219979978908E+02
43	-.914518501734778537E+01	.469692651391671698E+02
44	.378596233205332080E+02	.316964770925368949E+02
45	.483700046889919775E+02	-.177509795556155915E+02
46	.996390488212540711E+01	-.523319871474247411E+02
47	-.402603134268898098E+02	-.360131493909243446E+02
48	-.514744945989714737E+02	.167454250043974343E+02
49	-.105527811346181843E+02	.535915013072985069E+02
50	.428908528201712561E+02	.362266119971256837E+02

PUV (COS THETA) = .483971447812410585E+02

QUV (COS THETA) = .642099979395653848E+02

MU = 1.00 NU = .05 THETA = 30.0 DEGREES

K	PSP	QSP
1	.10106207746480638E+01	.54872230976817857E+00
2	.29558416650739587E+01	-.64331058499107007E+00
3	.28665539260663338E+01	-.40530717718072158E+01
4	-.11231877300293138E+01	-.62193247440692437E+01
5	-.59564967247308395E+01	-.32574691827923264E+01
6	-.57785652140420492E+01	.35374610708048200E+01
7	.11867741960816040E+01	.73193317619259933E+01
8	.89068525530900454 1E+01	.25884616133862026E+01
9	.86402978530643768 5E+01	-.75908516989749120 6E+01
10	-.13002339783013470 1E+01	-.12988120114252240 9E+02
11	-.11906829788369614 8E+02	-.64883898423607059 6E+01
12	-.11551657178973700 9E+02	.70751048949735251 7E+01
13	.13639405063519595 0F+01	.14087702272458095 0E+02
14	.14856962716861066 4E+02	.58191676274685069 4E+01
15	.14413174326075341 4E+02	-.11128427270544644 1E+02
16	-.14774334925315255 3E+01	-.19756323356376350 8E+02
17	-.17856839103164097 9E+02	-.97190106889170863 2E+01
18	-.17324435986984570 E+02	.10612643595579116 9E+02
19	.15411525431056621 0E+01	.20855822421385250 6E+02
20	.20806917847973233 1E+02	.90497462584434458 1E+01
21	.20185900641156088 6E+02	-.14665944066845613 3E+02
22	-.16546512158445407 8E+01	-.26524396180852951 8E+02
23	-.23806761764317076 8E+02	-.12949565377786080 5E+02
24	-.23097130837711170 6E+02	.14150146378814136 2E+02
25	.17183731810301128 2E+01	.27623865725190251 8E+02
26	.26756819515377244 6E+02	.12280286077702938 1E+02
27	.25958575124246255 5E+02	-.18203437362081831 5E+02
28	-.18318734819288473 5E+01	-.33292419828313657 4E+02
29	-.29756649075011137 8E+02	-.16180095336242092 9E+02
30	-.28869791398152745 0E+02	.17687632958719328 2E+02
31	.18955964170516541 4E+01	.34391875624571473 7E+02
32	.32706696575028330 2E+02	.15510809164304983 4E+02
33	.31731225742539608 9E+02	-.21740919017626236 8E+02
34	-.20090973252416130 2E+01	-.40060419734920281 1E+02
35	-.35706518559843013 5E+02	-.19410613444073262 6E+02
36	-.34642434669333410 4E+02	.21225110897273369 8E+02
37	.20728206559102752 0E+01	.41159868039794900 5E+02
38	.38656560304174643 7E+02	.18741323550232416 9E+02
39	.37503863430750979 4E+02	-.25278394082315867 6E+02
40	-.21863218300882377 7E+01	-.46828406389394000 1E+02
41	-.41656377813058986 2E+02	-.22641124975102287 2E+02
42	-.40415068015748336 9E+02	.24762583694494553 1E+02
43	.22500453443656580 7E+01	.47927850169088467 7E+02
44	.44606416007966191 9E+02	.21971832843686966 2E+02
45	.43276493333999403 E+02	-.28815865059264693 7E+02
46	-.23635466480610826 1E+01	-.53596384899250868 5E+02
47	-.47606230654707004 6E+02	-.25871632482412351 2E+02
48	-.46187695142467331 3E+02	.28300053188137785 2E+02
49	.24272702553597258 9E+01	.54695825738613374 9E+02
50	.50556266508059822 2E+02	.25202338902574922 2E+02

PUV (COS THETA) = .57046637893823300 1E+02

QUV (COS THETA) = .44669982639694817 6E+02

MU = 1.00 NU = 1.50 THETA = 30.0 DEGREES

K	PSP	QSP
1	.160505526608920260E+01	-.430073262355922606E+00
2	.235768347521206716E+01	-.323891997801202715E+01
3	-.533873799600301569E+00	-.613047725282439587E+01
4	-.560296435676092774E+01	-.477221853167297624E+01
5	-.725834217316422042E+01	.140573558486653690E+01
6	-.192816296228938916E+01	.673591479574136816E+01
7	.645275581969027403E+01	.449025437627908886E+01
8	.899249081789166128E+01	-.498816567476933954E+01
9	.125152030580918091E+01	-.127291361868518199E+02
10	-.104176624099737599E+02	-.960238810182656566E+01
11	-.138375431279701317E+02	.316078049356102596E+01
12	-.369386870164155226E+01	.133044549198896054E+02
13	.112554985479275725E+02	.929878403801128444E+01
14	.155538915327123862E+02	-.674303697210327637E+01
15	.301096673333675227E+01	-.192859617714789103E+02
16	-.152148567925160616E+02	-.144023670763344913E+02
17	-.203909584615884015E+02	.491510733778554835E+01
18	-.545057626577562264E+01	.198554895335983272E+02
19	.160496768176708196E+02	.140945140828240971E+02
20	.221030326014730651E+02	-.849691725861680738E+01
21	.476624316747117537E+01	-.258337066926186971E+02
22	-.200072154062045568E+02	-.191956784740764117E+02
23	-.269375431627792439E+02	.666865682656515525E+01
24	-.720501443098432621E+01	.264011855583600730E+02
25	.208408537451429487E+02	.188863178295370454E+02
26	.286479663300868718E+02	-.102502229978840680E+02
27	.652014946177519881E+01	-.323780398661957410E+02
28	-.247975817356863500E+02	-.239864790830609415E+02
29	-.334813486532338791E+02	.842178025431221480E+01
30	-.895856268980455312E+01	.329445662177415408E+02
31	.256306399637202348E+02	.236764172998931273E+02
32	.351909665967207611E+02	-.120032074314187324E+02
33	.827344546369540946E+01	-.389207265644440841E+02
34	-.295869385359049418E+02	-.287760692466189704E+02
35	-.400237540963389895E+02	.101746566941463420E+02
36	-.107116744099945910E+02	.394867363804907405E+02
37	.304196700153264430E+02	.284656258581196086E+02
38	.417329201617313212E+02	-.137559984869994362E+02
39	.100264185371621999E+02	-.454625001115685575E+02
40	-.343757142003168053E+02	-.335649845023415423E+02
41	-.465653563088775195E+02	.119273791728880635E+02
42	-.124645405923551052E+02	.460281948894104779E+02
43	.352082437590199829E+02	.332543108215164591E+02
44	.482742437804046013E+02	-.155086651099869740E+02
45	.117792005975916777E+02	-.520037082927998976E+02
46	-.391641249915237934E+02	-.383534853414406587E+02
47	-.531064552954426899E+02	.136799997286918894E+02
48	-.142172552763111882E+02	.525691997478233910E+02
49	.399965211458351181E+02	.380426621368678473E+02
50	.548151590028692997E+02	-.172612472445473074E+02

PUV (COS THETA) = .618522834598657480E+02

QUV (COS THETA) = -.305947641500301026E+02

MU = 1.50 NU =-1.50 THETA = 30.0 DEGREES

K	PSP	QSP
1	.4999999999999701-100	.8660254037844381 28-100
2	.1999999999999744E+01	.1514612938024340 73E-27
3	.4999999999999360E+01	-.5196152422706625 23E+01
4	-.9999999999998720E+00	-.1558845726811987 57E+02
5	-.2099999999999731E+02	-.1558845726811987 57E+02
6	-.3599999999999539E+02	.1039230484541325 05E+02
7	-.1499999999999808E+02	.4676537180435962 71E+02
8	.4099999999999475E+02	.4676537180435962 71E+02
9	.7699999999999022E+02	-.1558845726811987 71E+02
10	.3199999999999598E+02	-.9353074360871925 55E+02
11	-.7799999999998962E+02	-.9353074360871925 55E+02
12	-.1439999999999811E+03	.2078460969082649 86E+02
13	-.6599999999999113E+02	.1558845726811987 54E+03
14	.1159999999999855E+03	.1558845726811987 54E+03
15	.2209999999999721E+03	-.2598076211353312 87E+02
16	.1009999999999875E+03	-.2338268590217981 38E+03
17	-.1709999999999777E+03	-.2338268590217981 38E+03
18	-.3239999999999581E+03	.3117691453623974 88E+02
19	-.1529999999999800E+03	.3273576026305173 87E+03
20	.2269999999999713E+03	.3273576026305173 87E+03
21	.4369999999999444E+03	-.3637306695894637 91E+02
22	.2059999999999740E+03	-.4364768035073565 21E+03
23	-.2999999999999612E+03	-.4364768035073565 21E+03
24	-.5759999999999258E+03	.4156921938165299 93E+02
25	-.2759999999999643E+03	.5611844616523155 22E+03
26	.3739999999999525E+03	.5611844616523155 22E+03
27	.7249999999999076E+03	-.4676537180435962 96E+02
28	.3469999999999560E+03	-.7014805770653944 08E+03
29	-.4649999999999401E+03	-.7014805770653944 08E+03
30	-.8999999999999844E+03	.5196152422706624 98E+02
31	-.4349999999999439E+03	.8573651497465931 60E+03
32	.5569999999999291E+03	.8573651497465931 60E+03
33	.1084999999999861E+04	-.5715767664977288 00E+02
34	.5239999999999333E+03	-.1028838179695911 80E+04
35	-.6659999999999143E+03	-.1028838179695911 80E+04
36	-.1295999999999834E+04	.6235382907247950 02E+02
37	-.6299999999999189E+03	.1215899666913350 30E+04
38	.7759999999999010E+03	.1215899666913350 30E+04
39	.1516999999999806E+04	-.6754998149518613 05E+02
40	.7369999999999060E+03	-.1418549611398908 69E+04
41	-.9029999999998840E+03	-.1418549611398908 69E+04
42	-.1763999999999774E+04	.7274613391789275 07E+02
43	-.8609999999998894E+03	.1636788013152586 94E+04
44	.1030999999999868E+04	.1636788013152586 94E+04
45	.2020999999999742E+04	-.7794228634059938 10E+02
46	.9859999999998742E+03	-.1870614872174385 08E+04
47	-.1175999999999849E+04	-.1870614872174385 08E+04
48	-.2303999999999705E+04	.8313843876330600 11E+02
49	-.1127999999999855E+04	.2120030188464303 09E+04
50	.1321999999999831E+04	.2120030188464303 09E+04

PUV (COS THETA) = .1491717258900265 72E+04

QUV (COS THETA) = .3757655671579500 91E+04

MU = 1.50 NU = -.40 THETA = 30.0 DEGREES

K	PSP	QSP
1	.980107176607203394E+00	.499389549713500831E+00
2	.450252356197797981E+01	-.178809439734960999E+01
3	.401579916891860279E+01	-.110753490705671351E+02
4	-.105967078277706114E+02	-.185207932662956930E+02
5	-.319828073103788968E+02	-.463249787341252016E+01
6	-.300673113118871550E+02	.319173430986048368E+02
7	.142157129402746711E+02	.544806709356602835E+02
8	.685615657431380786E+02	.191880614666865737E+02
9	.642752509268409841E+02	-.625996974297129237E+02
10	-.257164080161840510E+02	-.108452737903407089E+03
11	-.128118084362320193E+03	-.419523117280723681E+02
12	-.120518903515844758E+03	.103048696718291572E+03
13	.312195075534340943E+02	.180363278823936292E+03
14	.196773077665860586E+03	.728515333119700833E+02
15	.184918983576833823E+03	-.153338056309940609E+03
16	-.446042970540894446E+02	-.270286009042847713E+03
17	-.288405831155823898E+03	-.111959441563979543E+03
18	-.271354776611872819E+03	.213394060859060208E+03
19	.519914910160854642E+02	.378147213214541528E+03
20	.389137059330145492E+03	.159202321138500921E+03
21	.365946997118897110E+03	-.283290425711250195E+03
22	-.672603749414867901E+02	-.504020606684617563E+03
23	-.512846047690890006E+03	-.214653887381134045E+03
24	-.482574930599971332E+03	.362953435520910744E+03
25	.765316633282287853E+02	.647832474107475991E+03
26	.645653510735992803E+03	.278240424946279087E+03
27	.607359291553030850E+03	-.452456805633641681E+03
28	-.936846416783760867E+02	-.809656530828716639E+03
29	-.801438733967518519E+03	-.350035649179535873E+03
30	-.754179365480140299E+03	.551726820703843180E+03
31	.104840024489864058E+03	.989419061502739681E+03
32	.966322431883402518E+03	.429965844735304579E+03
33	.909155866879235042E+03	-.660837196077115067E+03
34	-.123877097264757335E+03	-.118719378147514494E+04
35	-.115418388998570944E+04	-.518104726959185029E+03
36	-.108616808125237972E+04	.779714216407857515E+03
37	.136916574500991281E+03	.140290697540033260E+04
38	.135114382277237464E+04	.614378580505577398E+03
39	.127133672309750969E+04	-.908431597041670352E+03
40	-.157837741700630533E+03	-.163663235862390247E+04
41	-.157108151574546276E+04	-.718861120720081512E+03
42	-.147854107791668959E+04	.104691562263295375E+04
43	.172761313361610455E+03	.188829621580025474E+04
44	.180011768340290916E+04	.831478632257097545E+03
45	.169390186020785479E+04	-.119524000852730754E+04
46	-.195566574985995683E+03	-.215797226227498923E+04
47	-.205213161124677848E+04	-.952304830462225322E+03
48	-.193129835547306991E+04	.135333103937913189E+04
49	.212374241071721581E+03	.244558678270250611E+04
50	.231324401377500609E+04	.108126599998986502E+04

PUV (COS THETA) = .261021635355212178E+04

QUV (COS THETA) = .191649408553523991E+04

MU = 1.50 NU = .05 THETA = 30.0 DEGREES

K	PSP	QSP
1	.150717337661639680E+01	.361840313976652925E+00
2	.501778171265453763E+01	-.333756897818600929E+01
3	.199301829155776563E+01	-.135489991545322522E+02
4	-.157041142596799259E+02	-.177977047767097253E+02
5	-.348059537351815745E+02	.233143401886123093E+01
6	-.236441506883174299E+02	.400130495992011695E+02
7	.277455996046997127E+02	.523506370789857548E+02
8	.748290525821524250E+02	.273503010174534384E+01
9	.504179337048503067E+02	-.796755261101757451E+02
10	-.521670928971044401E+02	-.104304011996973734E+03
11	-.139622541738995771E+03	-.121451981598627082E+02
12	-.968498308265850797E+02	.132253053911286980E+03
13	.744331306514654340E+02	.173374454754504665E+03
14	.214650957720282941E+03	.256156953793018628E+02
15	.148404378568093075E+03	-.198029007778703879E+03
16	-.109079176353211359E+03	-.259845340127747553E+03
17	-.314449764011442597E+03	-.434298965362318138E+02
18	-.219617040414802957E+03	.276720012936257435E+03
19	.141569766516913554E+03	.363433293340533390E+03
20	.424483497127046080E+03	.653044268544835522E+02
21	.295952352881286064E+03	-.368609444160116657E+03
22	-.186440364628000681E+03	-.484421689169031183E+03
23	-.559287620552522049E+03	-.915226611102260872E+02
24	-.391945779452971057E+03	.473413926674112534E+03
25	.229155507201044077E+03	.622527152837071925E+03
26	.704326670802441844E+03	.121801224527290410E+03
27	.493061856644429276E+03	-.591416835254414077E+03
28	-.284250657721472404E+03	-.778033059120824624E+03
29	-.874136111362234126E+03	-.156423491881845529E+03
30	-.613836047941089380E+03	.722334795124852276E+03
31	.337190352703857002E+03	.950656033244120272E+03
32	.105418047874647023E+04	.195106088397722435E+03
33	.739732889857522711E+03	-.866451181061596140E+03
34	-.402510055633626531E+03	-.114067944998312788E+04
35	-.125899523644057883E+04	-.238132388851090139E+03
36	-.885287845879157927E+03	.102348261828847666E+04
37	.465674303025352329E+03	.134781993456167843E+04
38	.147404492095913125E+04	.285219018465779629E+03
39	.103596545252056637E+04	-.119371248158166285E+04
40	-.541218558364463059E+03	-.157236086175594094E+04
41	-.171386499578755616E+04	-.336649352017959916E+03
42	-.120630117326717670E+04	.137685739616498569E+04
43	.514607358165530059E+03	.181401865678974640E+04
44	.196391997440424489E+04	.392140014731461991E+03
45	.138175954463356025E+04	-.157320073681461420E+04
46	-.700376165913981990E+03	-.207307729443926381E+04
47	-.223874538940316611E+04	-.451974381382454862E+03
48	-.157687603010514569E+04	.178245912875437936E+04
49	.783989518124390191E+03	.234925279992832418E+04
50	.252380570819035116E+04	.515869077194769521E+03

PUV (COS THETA) = .284780978291872870E+04

QUV (COS THETA) = .914354132436944155E+03

MU = 1.50 NU = 1.50 THETA = 30.0 DEGREES

K	PSP	QSP
1	.25980762113533126 1E+01	-.14999999999999980 8E+01
2	.25980762113533126 1E+01	-.94999999999999878 4E+01
3	-.10392304845413250 5E+02	-.16999999999999978 2E+02
4	-.31176914536239751 4E+02	-.49999999999999936 0E+01
5	-.31176914536239751 4E+02	.29999999999999961 6E+02
6	.10392304845413250 5E+02	.53999999999999930 9E+02
7	.64951905283832816 6E+02	.22499999999999970 5E+02
8	.64951905283832816 6E+02	-.57499999999999925 3E+02
9	-.20784609690826501 1E+02	-.10699999999999986 3E+03
10	-.12470765814495900 3E+03	-.46999999999999941 0E+02
11	-.12470765814495900 3E+03	.95999999999999874 9E+02
12	.20784609690826502 9E+02	.17999999999999976 7E+03
13	.18965956342879182 2E+03	.82499999999999892 1E+02
14	.18965956342879182 2E+03	-.14149999999999982 1E+03
15	-.31176914536239749 5E+02	-.26899999999999965 7E+03
16	-.28059223082615776 0E+03	-.12499999999999984 2E+03
17	-.28059223082615776 0E+03	.19799999999999974 4E+03
18	.31176914536239753 3E+02	.37799999999999951 4E+03
19	.37672105064623033 1E+03	.17849999999999976 9E+03
20	.37672105064623033 1E+03	-.26149999999999966 7E+03
21	-.41569219381652999 9E+02	-.50299999999999935 8E+03
22	-.49883063257983602 0E+03	-.23899999999999969 6E+03
23	-.49883063257983602 0E+03	.33599999999999956 8E+03
24	.41569219381653003 7E+02	.64799999999999916 8E+03
25	.62613636693614834 2E+03	.31049999999999960 0E+03
26	.62613636693614834 2E+03	-.41749999999999946 8E+03
27	-.51961524227066250 4E+02	-.80899999999999896 6E+03
28	-.77942286340599378 2E+03	-.38899999999999950 4E+03
29	-.77942286340599378 2E+03	.50999999999999934 5E+03
30	.51961524227066254 2E+02	.98999999999999873 0E+03
31	.93790551229854585 5E+03	.47849999999999938 5E+03
32	.93790551229854585 5E+03	-.60949999999999922 2E+03
33	-.62353829072479500 9E+02	-.11869999999999984 8E+04
34	-.11223689233046310 5E+04	-.57499999999999926 6E+03
35	-.11223689233046310 5E+04	.71999999999999907 6E+03
36	.62353829072479504 6E+02	.14039999999999982 0E+04
37	.13120284867334228 7E+04	.68249999999999912 4E+03
38	.13120284867334228 7E+04	-.83749999999999893 0E+03
39	-.72746133917892751 3E+02	-.16369999999999979 1E+04
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45	-.83138438763306001 8E+02	-.21589999999999972 4E+04
46	-.19953225303193440 9E+04	-.10549999999999986 5E+04
47	-.19953225303193440 9E+04	.12479999999999984 0E+04
48	.83138438763306005 5E+02	.24479999999999968 6E+04
49	.22473359228206154 1E+04	.11984999999999984 6E+04
50	.22473359228206154 1E+04	-.14014999999999982 1E+04

PUV (COS THETA) = .25358470367761511 5E+04
QUV (COS THETA) = -.24840940720440775 4E+04

APPENDIX B

CONVERGENCE OF THE HYPERGEOMETRIC SERIES ON $|z|=1$

We consider the series

$$\sum_{n=o}^{\infty} d_n Z^n,$$

where

$$d_n = \frac{(a)_n (b)_n}{n!\,(c)_n}$$

and

$$|Z|=1.$$

By an extension of a Weierstrass test for convergence (see, e.g., reference 7, page 401), if

$$\frac{d_{n+1}}{d_n} = 1 - \frac{\alpha}{n} - \frac{A_n}{n^{\lambda}},$$

where α is complex and arbitrary, $\lambda>1$, and where the A_n are bounded, then the series

$$\sum_{n=o}^{\infty} d_n Z^n, \quad |Z|=1,$$

I) converges absolutely for $\mathrm{Re}\{\alpha\}>1$,

II) converges conditionally if $Z\neq 1$ and $0<\mathrm{Re}\{\alpha\}\leq 1$,

III) diverges for $\mathrm{Re}\{\alpha\}\leq 0$.

To use this test in the present case, choose $\alpha=c+1-a-b$, $\lambda=2$, and

$$A_n = -\alpha\left[\frac{c+1+\frac{c}{n}+\frac{ab-c}{\alpha}}{1+\frac{1}{n}(c+1)+\frac{c}{n^2}}\right].$$

The A_n are clearly bounded, and one has

$$n\left[\frac{d_{n+1}}{d_n}-1\right] = n\left[\frac{\frac{(a)_{n+1}(b)_{n+1}}{(n+1)!(c)_{n+1}}}{\frac{(a)_n(b)_n}{n!(c)_n}}-1\right]$$

$$= \frac{\frac{ab-c}{n}-\alpha}{\frac{c}{n^2}+\frac{(c+1)}{n}+1}.$$

Thus

$$\frac{d_{n+1}}{d_n} = 1-\frac{1}{n}\left(\frac{\alpha-\frac{ab-c}{n}}{1+\frac{1}{n}(c+1)+\frac{c}{n^2}}\right)$$

$$= 1-\frac{\alpha}{n}+\left[\frac{\frac{\alpha}{n}-\frac{ab-c}{n^2}}{1+\frac{1}{n}(c+1)+\frac{c}{n^2}}\right]$$

$$= 1-\frac{\alpha}{n}+\left[\frac{\frac{\alpha(c+1)}{n^2}+\frac{\alpha c}{n^3}+\frac{ab-c}{n^2}}{1+\frac{1}{n}(c+1)+\frac{c}{n^2}}\right]$$

$$= 1 - \frac{\alpha}{n} - \frac{1}{n^2}(-\alpha)\left[\frac{c+1 + \frac{c}{n} + \frac{ab-c}{\alpha}}{1 + \frac{1}{n}(c+1) + \frac{c}{n^2}}\right]$$

$$= 1 - \frac{\alpha}{n} - \frac{A_n}{n^2},$$

as required.

Then since Re $\{\alpha\}$ = Re $\{c+1-a-b\}$ = - 2 Re $\{\mu\}$ +1, we have the desired results.

APPENDIX C

AN ORDER RELATION FOR LOG $\Gamma(z+a)$ FOR LARGE Z

From Stirling's formula (see, e.g. references 2, 5, and 8), we have

$$\log \Gamma(z) = (z-\tfrac{1}{2}) \log z - z+\tfrac{1}{2}\log(2\pi)+O(\tfrac{1}{z}).$$

Then

$$\log \Gamma(z+a)=(z+a-\tfrac{1}{2})\log(z+a)-(z+a)+\tfrac{1}{2}\log(2\pi)+O(\frac{1}{z+a})$$

$$=(z+a-\tfrac{1}{2})\log(z+a)-(z+a)+\tfrac{1}{2}\log(2\pi)+O(\tfrac{1}{z}),$$

since $\frac{1}{z+a} = \frac{1}{z} - \frac{a^2}{z^2} + \frac{a^2}{z^3} - \ldots$

It follows that

$$\log \Gamma(z+a)-\log \Gamma(z)=(z+a-\tfrac{1}{2})\log(z+a)-(z+a)$$

$$-(z-\tfrac{1}{2})\log z+z+O(\tfrac{1}{z}).$$

Writing $z+a = z(1+\frac{a}{z})$, we have

$$\log \Gamma(z+a)-\log \Gamma(z)=(z+a-\tfrac{1}{2})(\log z+\log(1+\tfrac{a}{z}))-z-a$$

$$-(z-\tfrac{1}{2})\log z+z+O(\tfrac{1}{z})$$

$$=a \log z + (z+a-\tfrac{1}{2})\log(1+\tfrac{a}{z})-a+O(\tfrac{1}{z}).$$

Now if $|z|$ is large enough so that $|\frac{a}{z}| < 1$,

$$\log(1+\frac{a}{z}) = \frac{a}{z} - \frac{1}{2}(\frac{a}{z})^2 + \ldots, \text{ and then}$$

$$(z+a-\tfrac{1}{2})\log(1+\frac{a}{z}) = a + O(\frac{1}{z}).$$

It follows that when $|z| > |a|$,

$$\log \Gamma(z+a) = \log \Gamma(z) + a \log z + O(\frac{1}{z}).$$

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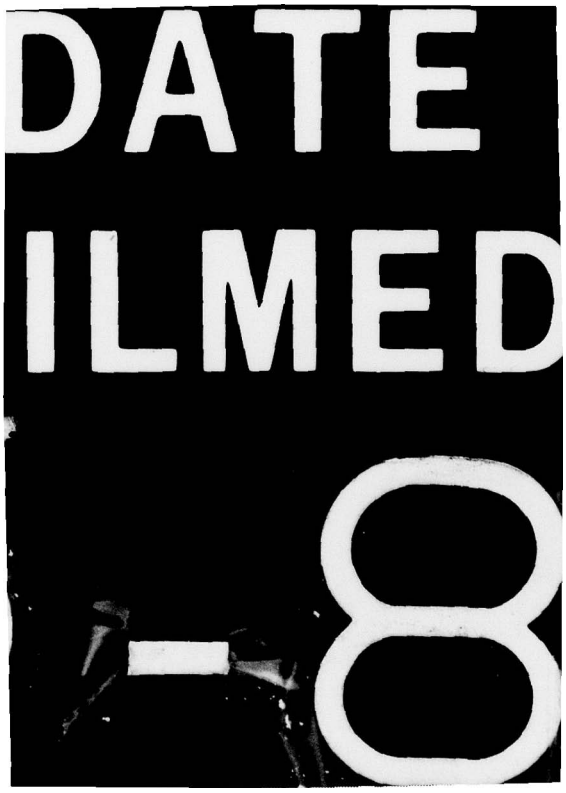
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